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Electrical World

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Grounding Offers New Opportunities for Cutting Costs

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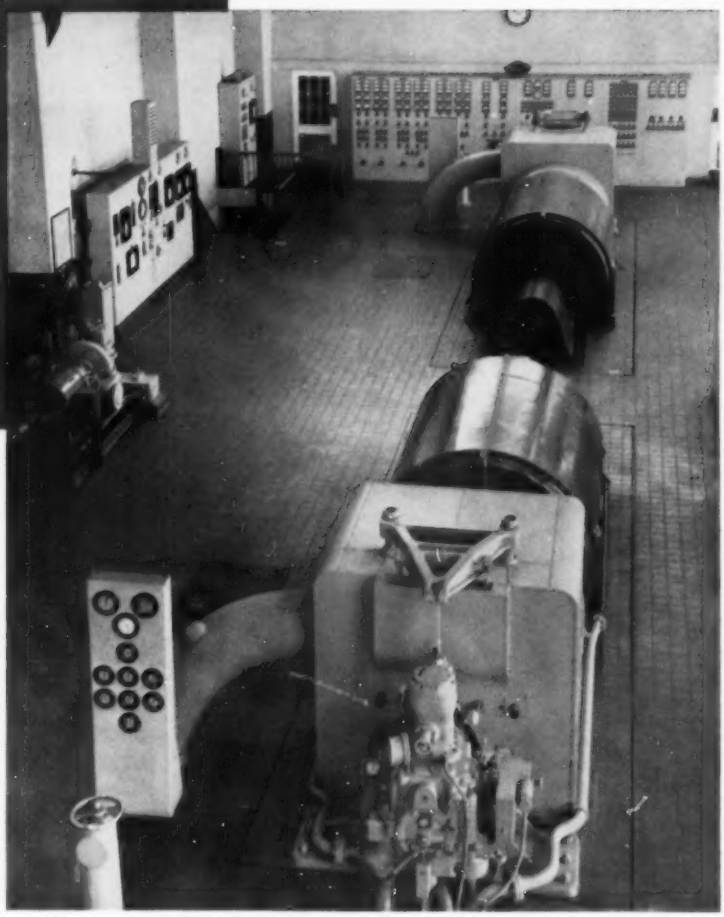

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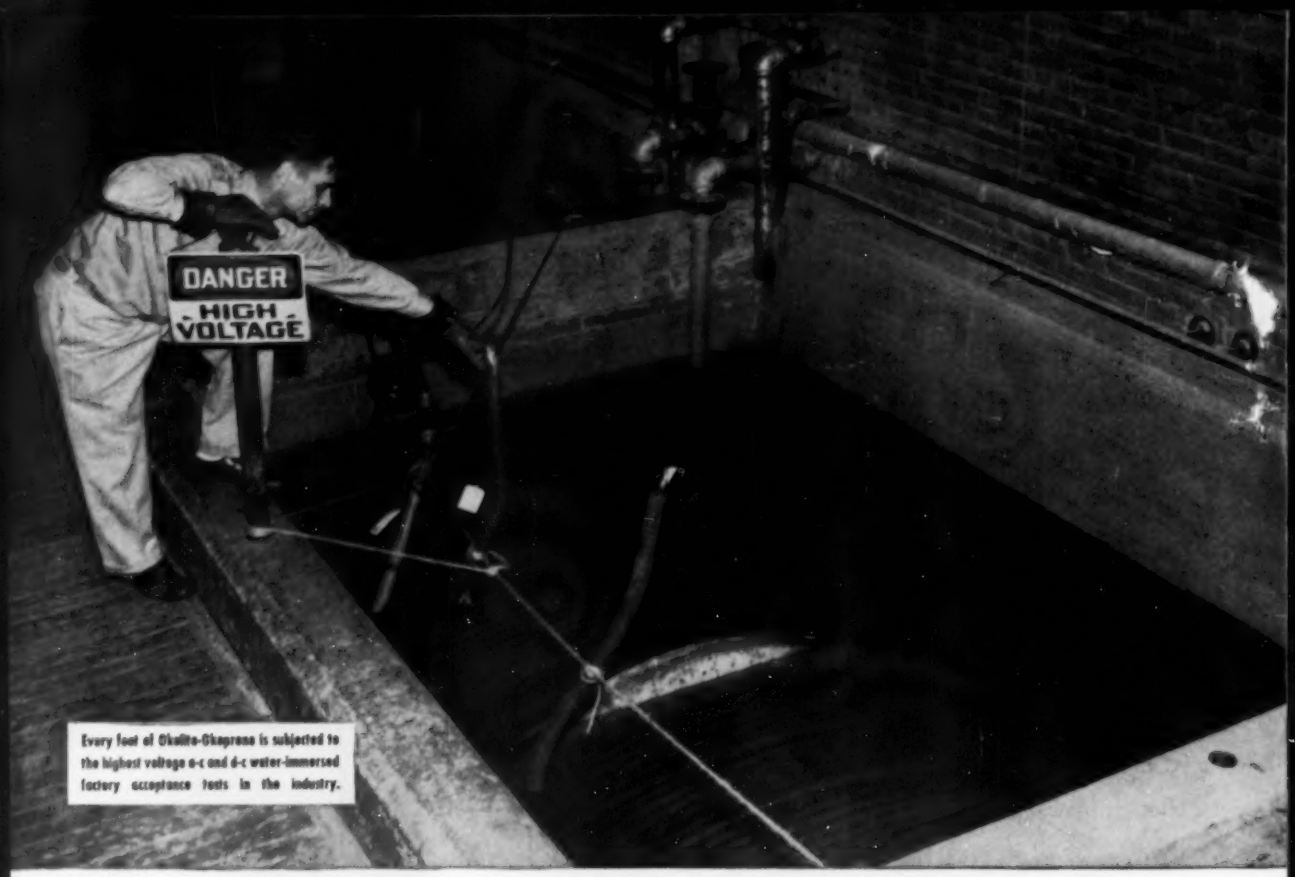

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Field service is the only true test of a cable's worth. And one case history after another shows that Okonite cables have given years of outage-free operation under the most difficult conditions. Premium materials and careful manufacturing methods have helped build this record. But materials and methods alone do not make dependable cable. Built into every Okonite construction are two all-important extras: research and quality control.

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1. **The use of the strip-insulating process, which applies a series of insulating strips of controlled thickness, insures a uniform wall of insulation and sheath.**
2. **Every foot of cable is subjected to the highest voltage a-c and d-c water-immersed factory acceptance tests in the industry.**
3. **Each batch of insulating and sheathing compound must meet a series of tests before it is applied to the conductor.**
4. **Foot-by-foot electrical testing and inspection of the insulation and sheath is carried on both before and during application to the conductor.**
5. **Okolite-Okoprene cables are always vulcanized in a metal mold to obtain maximum density and uniformity.**

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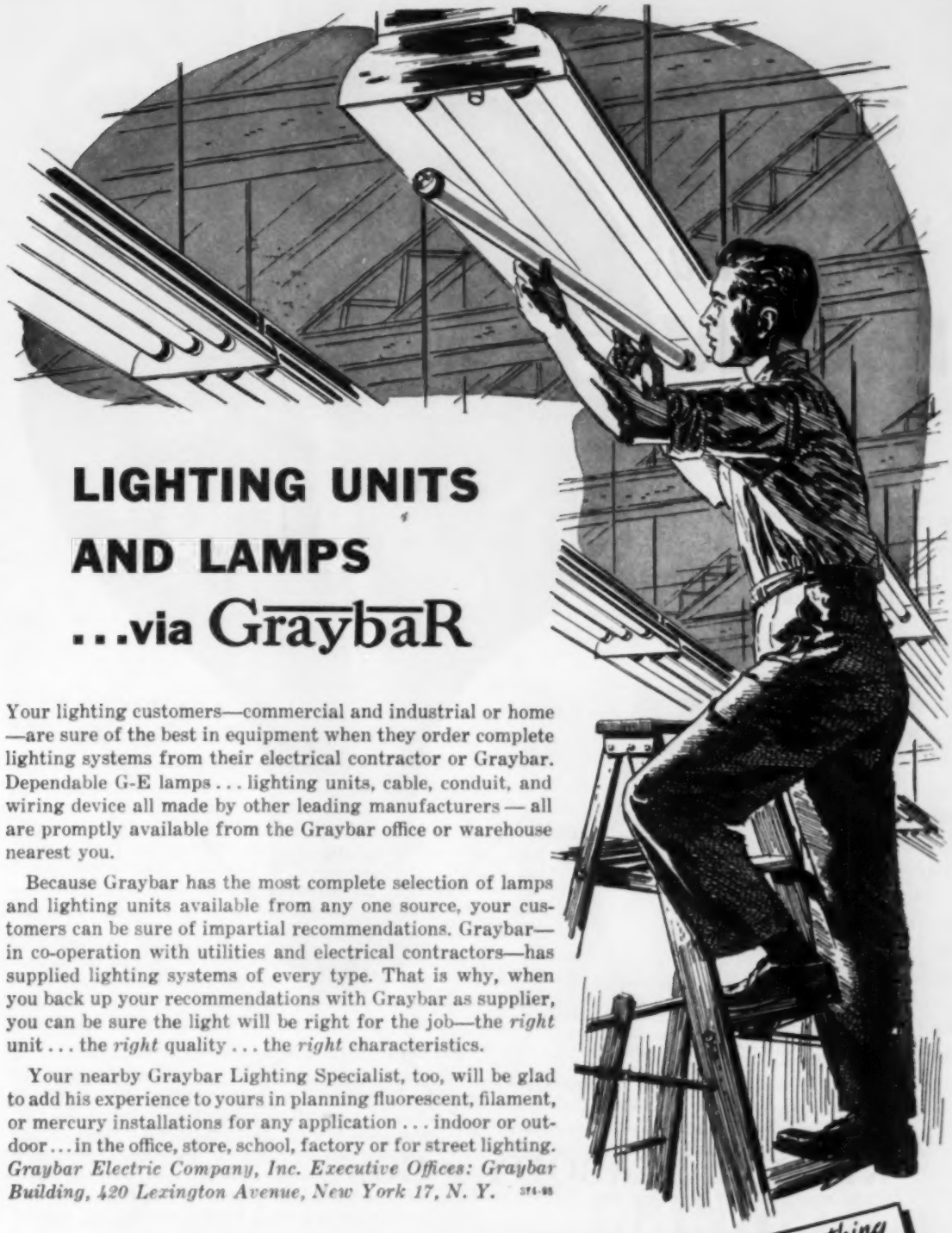

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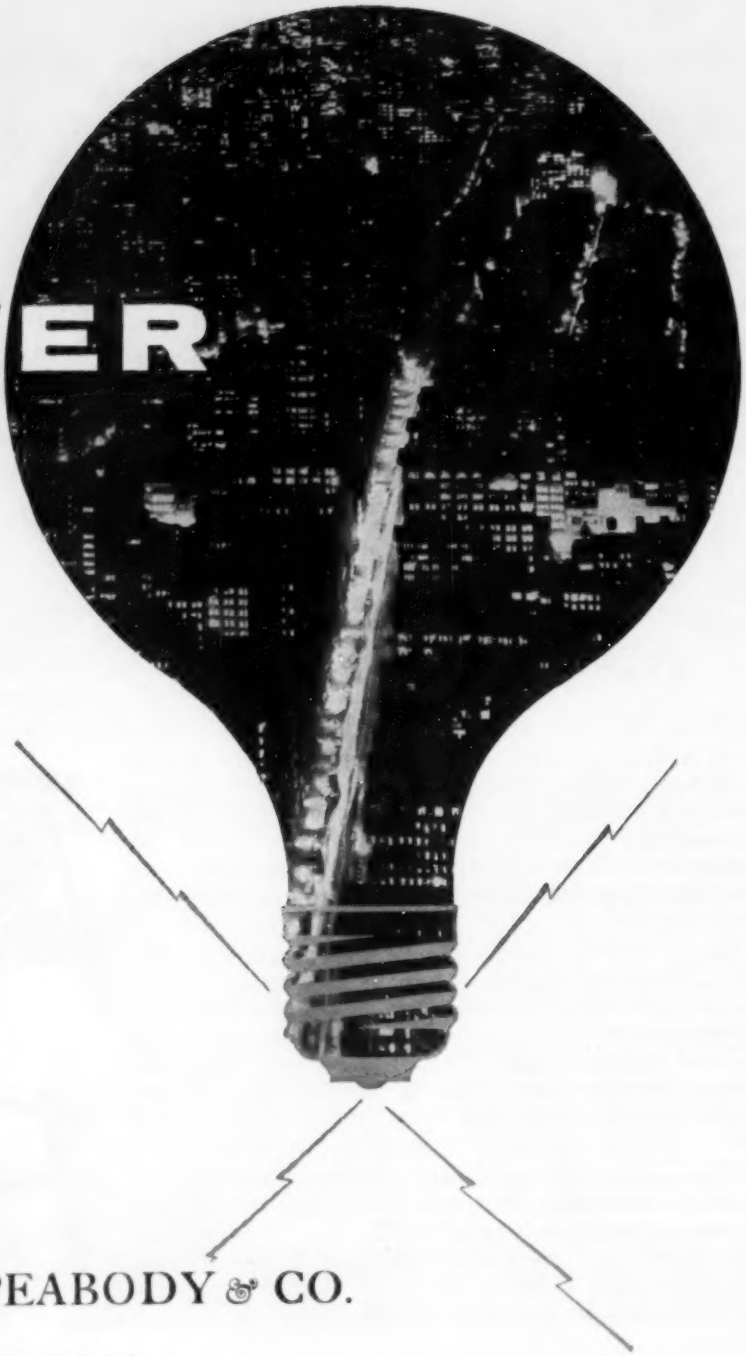

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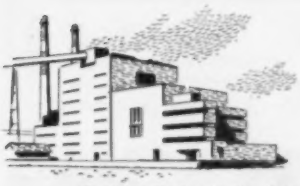
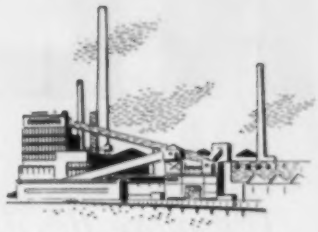
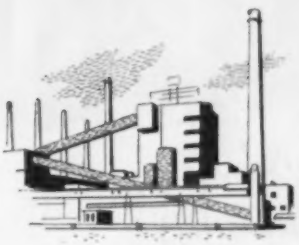


Salem Harbor Station in Salem, Mass.
Two 60,000 kw. units — '51 & '52



Webster St. Station in Worcester, Mass.
30,000 kw. unit — '50



South Street Station in Providence, R. I.
55,000 kw. topping unit — '53

Manchester St. Station in Providence, R. I.
Two 40,000 kw. units — '48 & '49

Proof of the reliability of GRINNELL PREFABRICATED PIPING

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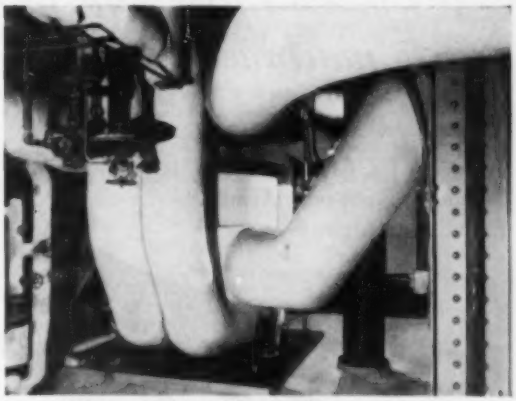

Main steam and reheat lines at reheat intercept valve, Salem Harbor Station.

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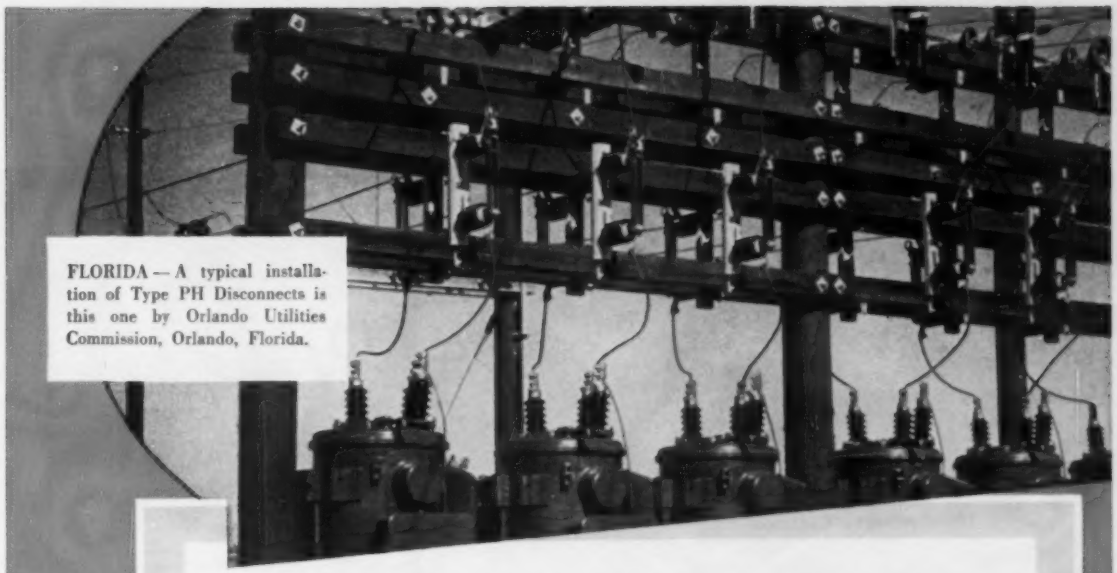
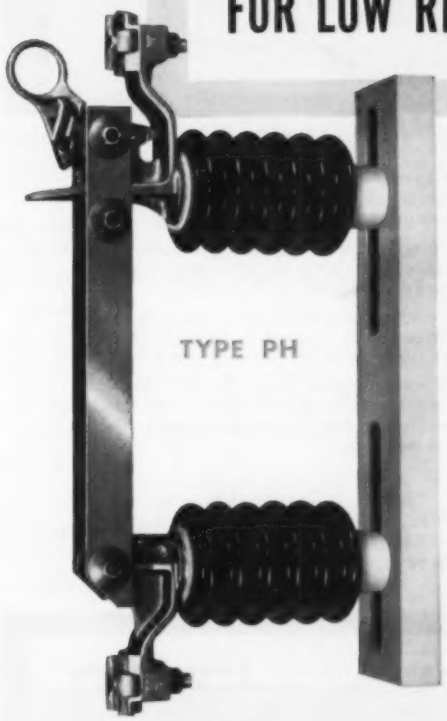


FLORIDA — A typical installation of Type PH Disconnects is this one by Orlando Utilities Commission, Orlando, Florida.

A LOW-COST, HIGH-QUALITY DISCONNECT FOR LOW REVENUE DISTRIBUTION LINES



SOUTHERN STATES TYPE PH HAS MANY DESIGN EXTRAS

It is often difficult to justify expensive switches for isolating, by-passing, or disconnecting on low revenue distribution lines. Yet the mechanical features of such disconnects are highly desirable, as any operating man knows.

That is why Southern States designed its popular, low-priced Type PH Disconnect. Its cost is easily justified, and yet it has many design extras found on more expensive switching equipment. For instance:

- **High-pressure line contacts**
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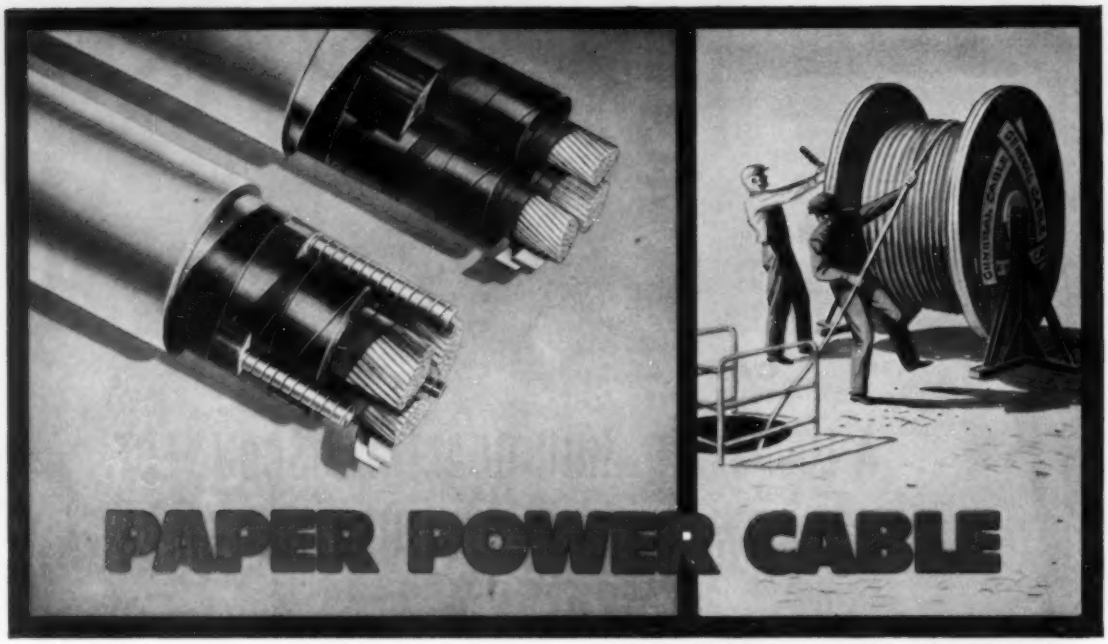

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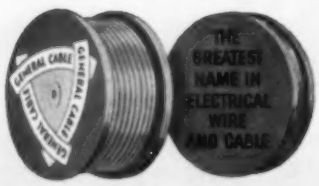

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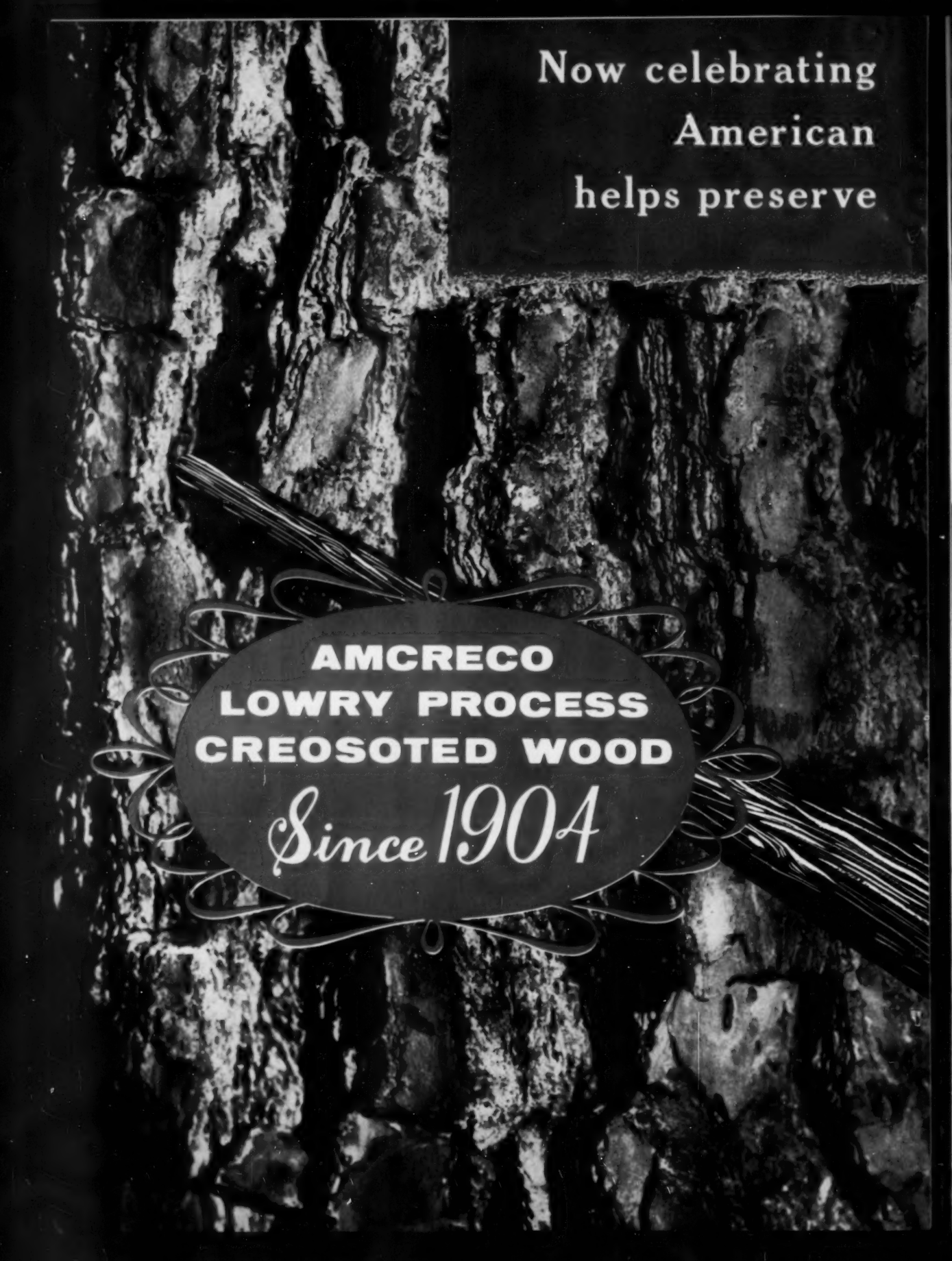
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Then, just when the picture looked blackest, Mr. C. B. Lowry introduced his Empty Cell Creosoting process and the modern era of wood preservation was born. It has been estimated that the modern wood preserving industry, founded by Lowry and pioneered by the American Creosoting Company, has saved the nation the equivalent of 500 million acres of forest in the past 50 years.

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In addition to helping save a great natural resource, wood treatment means one other thing to you. It means longer lasting service life for every piece of wood that you use. For example, wood treated by the American Creosoting Company lasts four, five, even ten times as long as untreated woods. In fact, under many conditions, wood treated by Amcreco can be considered essentially permanent.

Of course there are many different types of treatment processes—some tried and proven—others as yet untried by the big test of time. For that reason, when investing in treated woods, make sure you know their service record before you buy.

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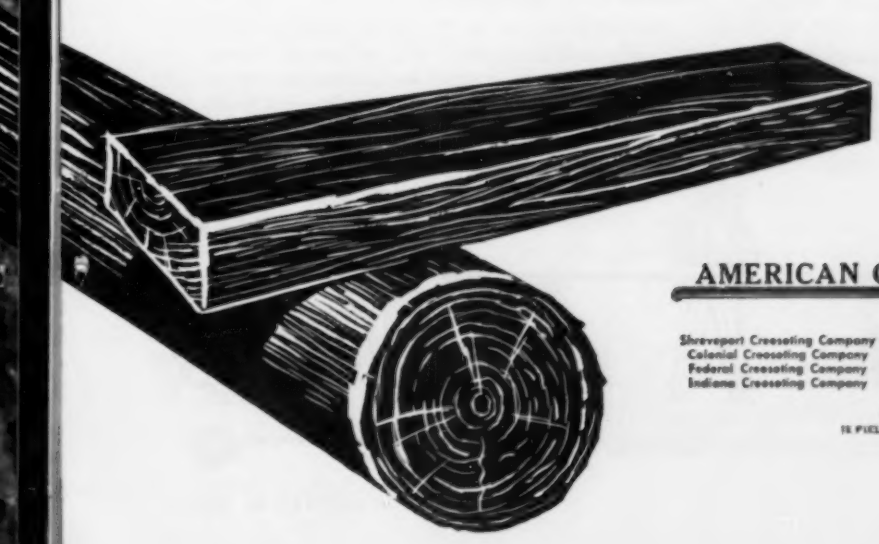

This year the United States Forest Service also celebrates its 50th anniversary. We are proud to share our birthday cake with them and to join the nation in thanking them for their invaluable contributions to conservation.

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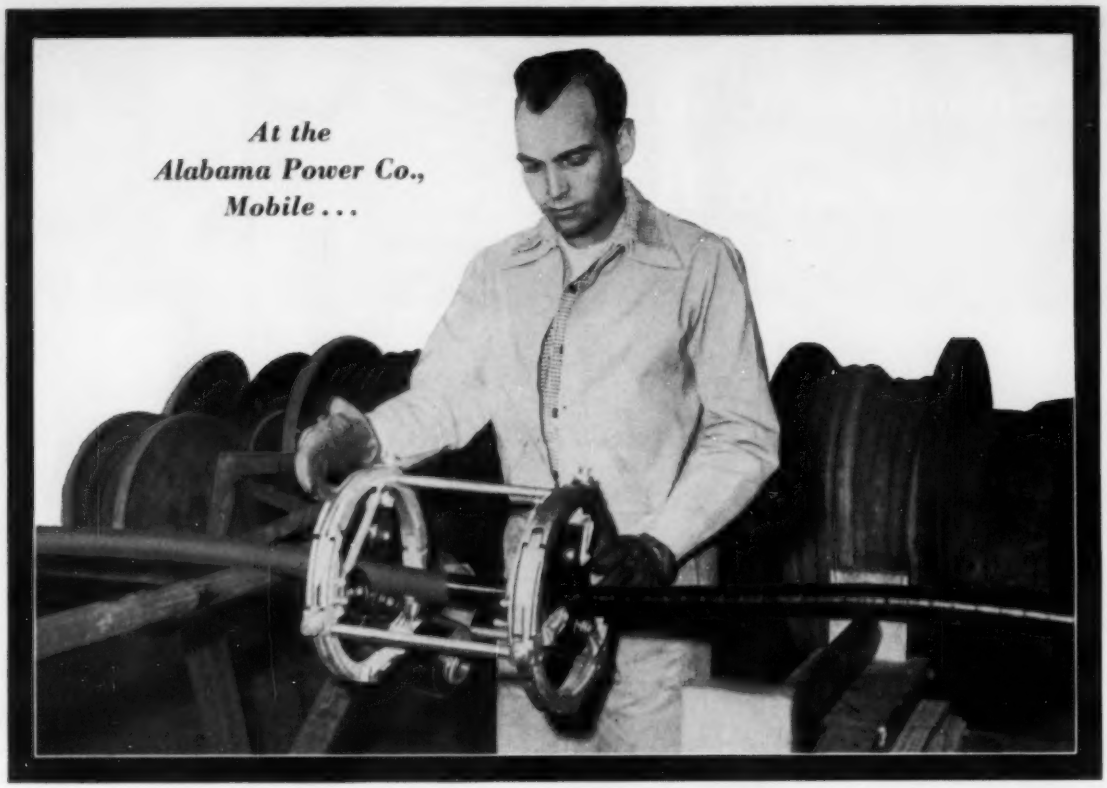

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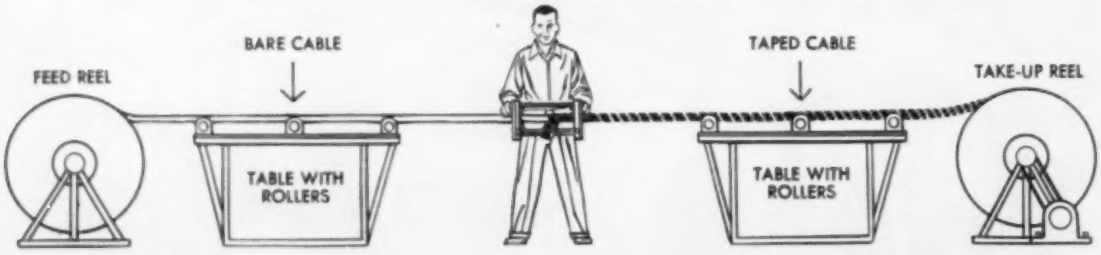
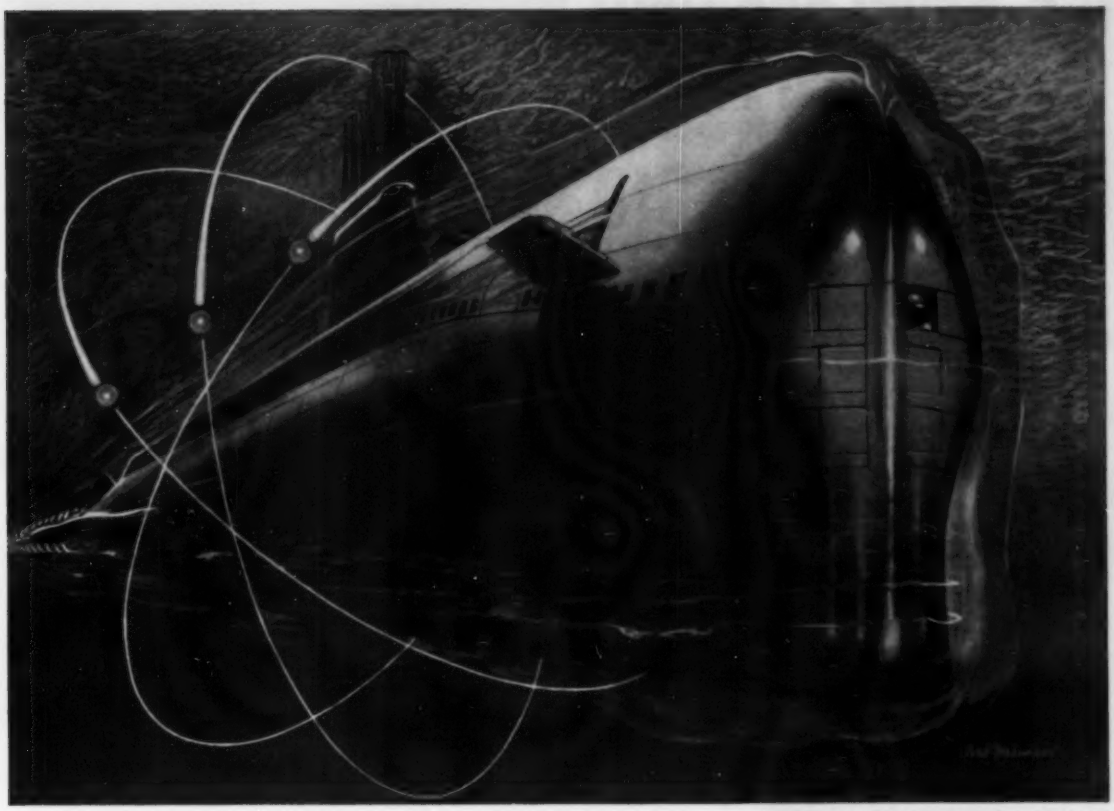
"SCOTCH" Plastic No. 21 can be applied by hand or machine. Will not crack. Will not dry out. Resists acids, alkalies, oils, galvanic and electrolytic action. Pressure-sensitive adhesive sticks tight—and *holds*. Write 3M Dept. BV-55 for the complete story.



The term "SCOTCH" and the plaid design are registered trademarks for the more than 300 pressure-sensitive adhesive tapes made in U.S.A. by Minnesota Mining and Mfg. Co., St. Paul 6, Minn. Export Sales Office: 99 Park Avenue, New York 16, N.Y. In Canada: P.O. Box 757 London, Ontario.



THE "NAUTILUS"

Atomic Sub and Builders Rely on World's Greatest Lubrication Knowledge

With the launching of the "Nautilus" — world's first atomic-powered submarine — the U.S. Navy crossed the threshold of the atomic age.

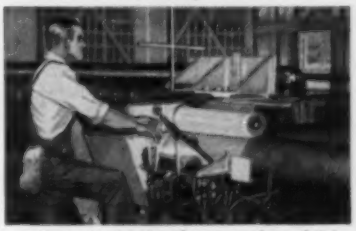
Socony-Vacuum is proud that it has been able to play a dual role in this most significant event.

First, famous Socony-Vacuum lubricants are now protecting vital machinery aboard the "Nautilus."

Second, Electric Boat Division, General Dynamics Corp. — builder of the "Nautilus" — relies 100% on our lubricants and a program of Correct Lubrication to protect its plant equipment... has done so for the past 34 years!

We wish the "Nautilus" and her crew all success... pledge our continued cooperation, in every way possible, to the Navy and its suppliers, toward the end of keeping America and her allies strong.

A snorkel intake tube being machined to very precise tolerances on one of the large lathes in the Groton plant.



Hydraulic bender shapes section of 8-in. steel pipe in two minutes. This operation formerly took a full day.

SOCONY-VACUUM *Correct Lubrication*

FIRST STEP IN CUTTING COSTS

SOCONY-VACUUM OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.

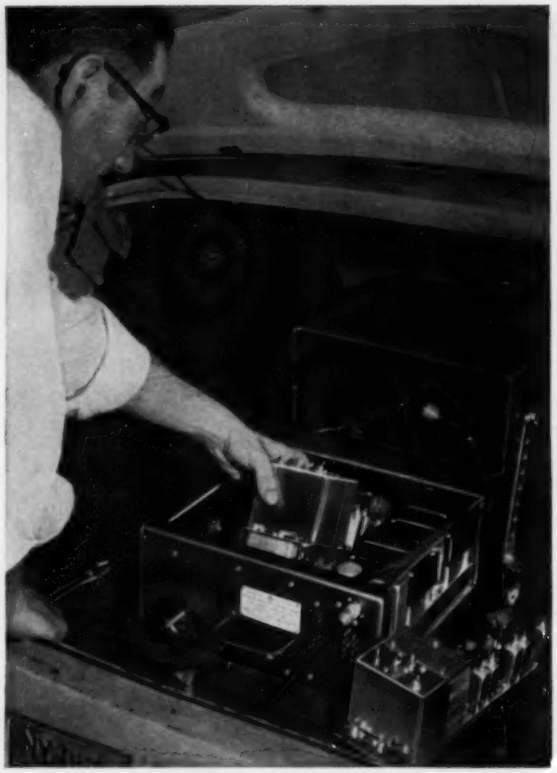
G.E. DEVELOPS NEW PLUG-IN CHASSIS FOR 2-WAY RADIO

NEW PROGRESS LINE saves money on maintenance through faster servicing—protects from obsolescence because chassis are quickly interchangeable.

IN the new Progress Line, transmitter, receiver, power supply and optional chassis are individually rack-mounted in a triple-rigid mobile case. Rapid interchangeability is provided by this rack construction and true plug-in chassis. This plug-in design permits changes in frequency, power, type of reception (narrow or wide band) quickly *at minimum cost, at any time.* You're free of any obsolescence risk!

You may switch Progress Line mobile units—whether front or trunk mount, between vehicles with 6 or 12 volt DC systems. No electrical alterations are needed. And any mobile combination can be converted quickly to a low-cost, 117 volt AC intermittent duty base station by changing only the power supply chassis!

Let a G-E Communications Counselor analyze your radio needs and develop an installation or conversion program planned for long-run savings. Write or call today for full specifications on the new PROGRESS LINE. *General Electric Company, Communication Equipment, Section X1955-2, Electronics Park, Syracuse, N. Y.*



INDIVIDUAL PLUG-IN CHASSIS minimize capital investment in spares and reduce radio maintenance time! Your vehicles will be back "in service" faster. For instance, you can replace either a transmitter or receiver plug-in chassis right in the vehicle in 5 minutes—using only a screwdriver. Individual plug-in chassis of the new General Electric Progress Line units also provide complete interchangeability between mobile and station transmitters and receivers.

There is a G-E Authorized Service Station near you. Look for this sign.

EASY FRONT MOUNTING under the dash. The new G-E Progress Line case is less than 15" deep. For the first time you can have a 90-watt front mount mobile unit in the 25-54 MC band and a 50-watt front mount mobile unit in the 144-174 MC band. In the 25-54 MC band you can now have simultaneous monitoring of 2 channels, in the same case, without additional equipment.

Progress Is Our Most Important Product

GENERAL ELECTRIC

You get more for your Money!

1. Higher Interrupting Capacity.
2. Heavy duty service at normal duty cost.

You know that the Distribution Engineer and the Linemen are satisfied

3. Bird proof—prevents unnecessary outages.
4. Positive-grip fuse leader anchor, no loose leaders.
5. Precise interruption of heavy or medium faults.
6. Fully fuse-hook operated.
7. Latest NEMA standard construction.
8. Color-coded fuse holders, easy to identify.
9. Interchangeable fuse holders and switch blades.

WHAT THE P. A. LIKES *when buying* R&IE Series "C" Cutout

Ratings

Max. Des. Kv	Interr.-Kv. Heavy Duty	Interr.-Kv. Extra Heavy Duty
5.2	5	10
7.8	5	10
15	4	8
18	1.2	

Easy to Order and Stock . . .

Coded catalog numbers identify each cutout. Fuse holders and mounts can be packaged separately—convenient to stock and requisition.

"Ask for a demonstration."

R&IE EQUIPMENT DIVISION
I-T-E CIRCUIT BREAKER CO.
GREENSBURG, PA.

STRUCTURES—steel or aluminum ● TESTING DEVICES ● KIRK KEY INTERLOCK SYSTEMS ● ISOLATED PHASE BUS STRUCTURES ● INTERRUPTER SWITCHES

INDOOR BUS SUPPORTS and BUS FABRICATION ● OUTDOOR BUS SUPPORTS and AIR SWITCHES ● SUBSTATION

Bogen
HIGH FIDELITY
BECAUSE IT SOUNDS BETTER

TRANSFORMERS ARE INSULATED *with* NATVAR Straight Cut V.C.

With the new Bogen R-765 Auto-Lock Tuner, you simply tune until you hear the FM station you want. Then the R-765 automatically "zeros in" to optimum adjustment and locks into position.

Operator of this multi coil winder finds it easy to insert Natvar V.C. as interwinding insulation, because it is always pliable and never sticky.

Leads are dead soft, but are easily inserted in Natvar Varnished Fiberglas Sleeving because it is so smooth inside. Operator slips sleeving back while stripping the enamel before hot tin dipping.

Natvar Products

- Varnished cambric—cloth and tape
- Varnished canvas and duck
- Varnished silk and special rayon
- Varnished—Silicone coated Fiberglas
- Varnished papers—rope and kraft
- Slot cell combinations, Abaglas®
- Vinyl coated—varnished—lacquered tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape
- Extruded identification markers

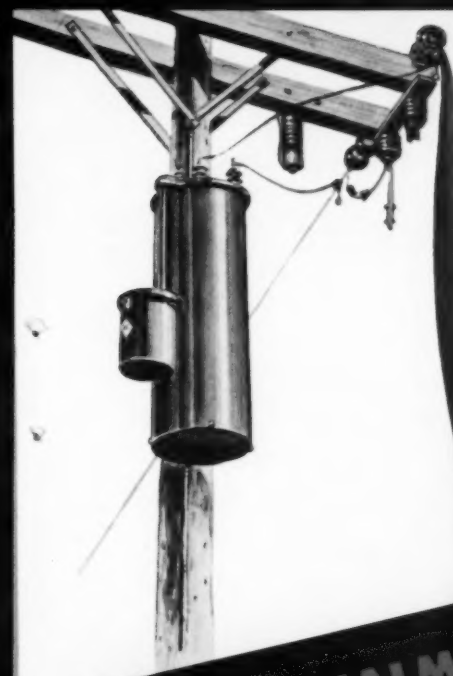
Ask for Catalog No. 23

THE DAVID BOGEN CO., INC., manufactures high fidelity home music systems of highest quality. Their matched tuners, amplifiers, record players and accessory units are noted for their flat frequency response over the entire audio range, minimal distortion, and other features such as the Bogen Auto-Lock tuning circuit to simplify tuning and eliminate drift.

Engineering and design are up to the minute, and components are carefully built of the best of suitable materials. Natvar straight cut varnished cambric is used as transformer interwinding insulation because "it is soft, pliable, and easy to handle, of uniform thickness throughout the sheet, with no thin spots. It is consistently good. Each shipment is exactly like the last."

Natvar flexible insulations are uniformly dependable no matter where or when purchased. They are available either from your wholesaler's stock or direct from our own.

NATVAR CORPORATION
FORMERLY THE NATIONAL VARNISHED PRODUCTS CORPORATION
TELEPHONE RAHWAY 7-8800
CABLE ADDRESS NATVAR: RAHWAY, N. J.
221 RANDOLPH AVENUE • WOODBRIDGE, NEW JERSEY



Carry twice the load

ALLIS-CHALMERS

5/8% STEP VOLTAGE REGULATORS

with present Wire

Little Extra Cost

Here's how: Use all the copper in your line to carry load. Most lines have extra copper to take care of voltage drop. You'll no longer need this provision when Allis-Chalmers distribution regulators control voltage automatically.

Doubling the load doubles the voltage drop. On a line with 10% voltage drop, increasing the load 100% makes the voltage drop 20%. Then, utilizing the ± 10% range of an Allis-Chalmers voltage regulator, you bring the voltage drop back to 10% again.

REGULATORS ARE ALL YOU BUY

Capital expense is held to a minimum. All you buy is low-cost Allis-Chalmers distribution regulators. No wire to buy, no costly labor charges. In addition, you will get close voltage control, which results in higher revenue and fewer voltage complaints for your system.

ALLIS-CHALMERS

A-4614

A-C ALLIS-CHALMERS

Originators of 5/8% Step Regulation

To get more facts on the regulator that can do the job, turn the page.

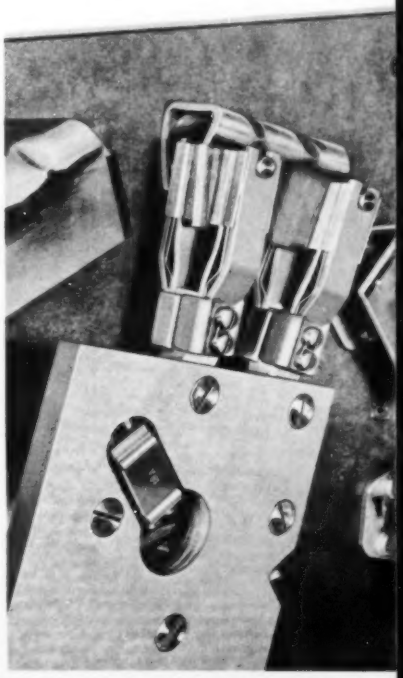
To Double the Loads

use the

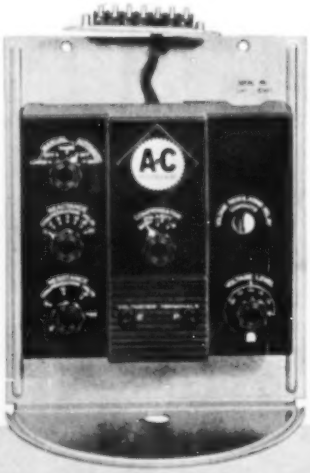
ALLIS-CHALMERS

5/8% STEP VOLTAGE REGULATORS

Designed and Built



Simple Design for Control Accuracy



Feather-Touch control on Allis-Chalmers distribution regulators gives you ± 1 volt band, Class 1 accuracy. Friction can never upset accuracy because the floating beam of the regulating relay eliminates the need for a mechanized bearing. You are assured of accuracy over the life of the regulator.

You get ease of installation and operation. Key adjustments are preset at the factory. Your operating men have a minimum of adjustments during installation. And it's easy to make the few settings that are needed with the large, easy-to-read calibrations.

A-C ALLIS-CHALMERS

ALLIS-

with Present Circuits

Regulator with Proved Reliability

Thousands of installations, more than ten years of field operation show why Allis-Chalmers distribution regulators are the logical choice for load-expanding assignments. No other distribution regulator now on the market can match their combination of proved service life and high quality.

▶ Here's what you get with Allis-Chalmers distribution regulators: a narrow ± 1 volt band, thirty-two small ⅝% steps, ± 10% range of regulation, easy control adjustment, close average voltage maintained by voltage integrator, and long-life unit construction.

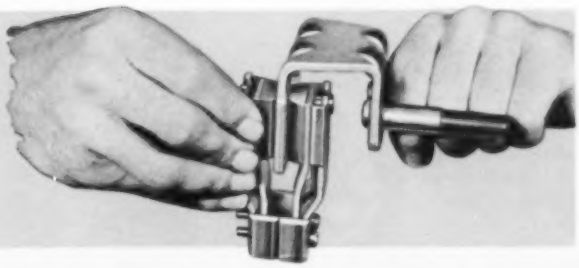
Not only for load-expanding assignments but for every voltage application you'll find Allis-Chalmers distribution regulators will cut costs, increase profits. Join the hundreds of distribution engineers who prefer Allis-Chalmers. Call the nearby A-C office for information.

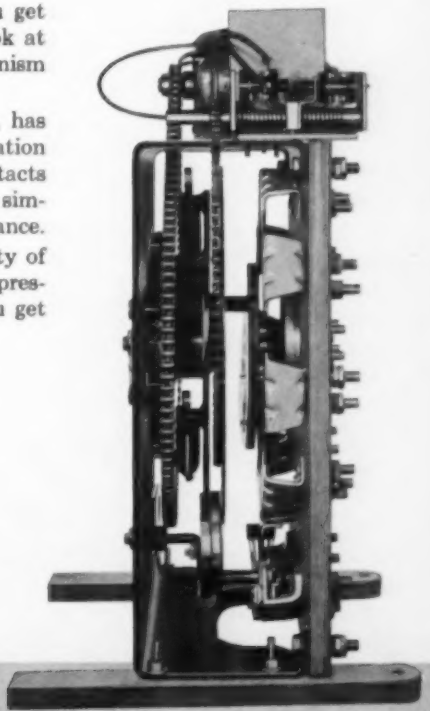
for Long Life, Low Maintenance

▶ At low cost, in Allis-Chalmers distribution regulators you get rugged, simple design and highest quality construction. Look at the mechanism: it is the same famous *Quick-Break* mechanism used on Allis-Chalmers voltage regulators for over 20 years.

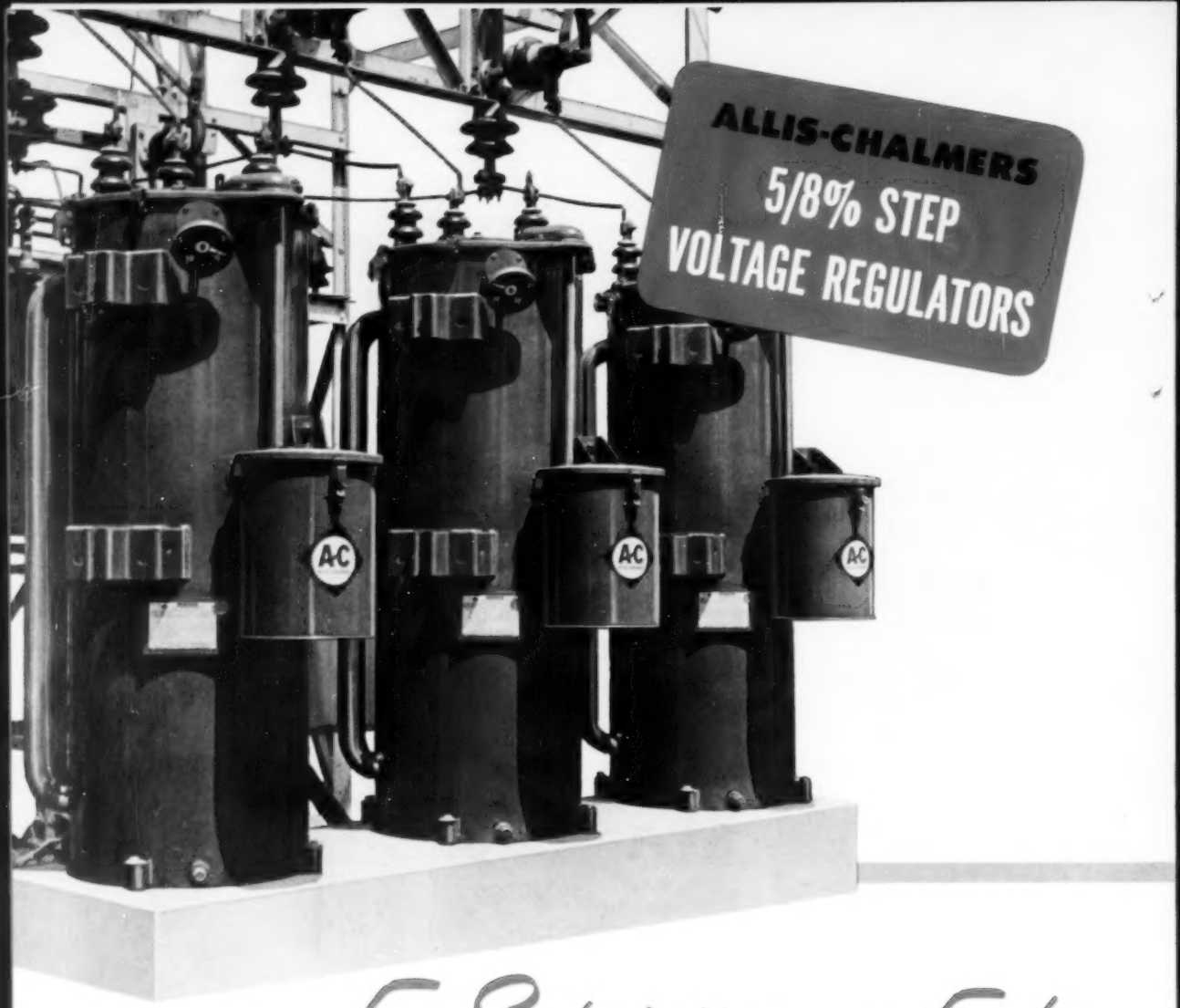
This unit has withstood over five million test operations, has been proved in thousands of field installations. Only operation can show how its rugged design complements the large contacts and heavy contact pressure, but the photo does show the simplicity that results in reliable operation, simplified maintenance.

A close look at the contacts on the dial switch shows plenty of arc-resisting material for extra-long operating life. Contact pressure is so strong you can't pull contacts apart. Result: You get long contact life with low maintenance.





CHALMERS MILWAUKEE 1, WISCONSIN



Low-cost regulation *For Substation or Feeder*

Allis-Chalmers distribution regulators are the low-cost, high-quality answer to almost any regulator problem. They give you highest quality features of regulation combined with low cost and flexibility of installation. Use them either out on the line or in a substation. If load conditions change, moving them to another location is simple and low in cost.

Buy Voltage Insurance

Many utilities find that Allis-Chalmers distribution regulators give permanent insurance against low voltage. Their flexibility makes it possible for them to earn their keep many times over, not only at the place they were originally installed but on other feeders as well.

Increase Revenues Now

Here's why it will pay you to get all the facts immediately: Allis-Chalmers distribution regulators increase revenue—and profits—on any system where voltage may be low. As loads increase the profit possibilities of adding regulation increase in proportion. The way to assure these profits is to investigate Allis-Chalmers distribution regulators now and apply them where needed.

Call your nearest A-C district office or write Allis-Chalmers, Milwaukee 1, Wisconsin, for complete information.

ALLIS-CHALMERS

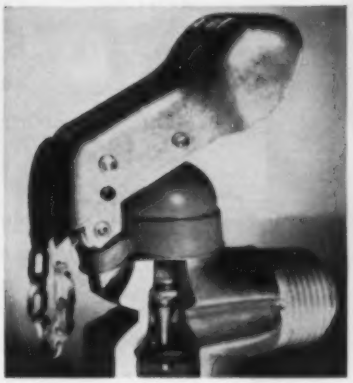
Originators of 5/8% Step Regulation

A-C ALLIS-CHALMERS

Here's why Ansul extinguishers give you faster, more dependable fire protection!

READY for instant action under the most severe exposure conditions.

WEATHER-TIGHT NOZZLES made of aluminum and stainless steel, can't rust. Neoprene cap and oil-impregnated washers keep out moisture.



PUNCTURE PIN. In this aluminum housing a stainless steel pin pierces the gas cylinder that supplies the propellent power for the dry chemical.

PATENTED NOZZLES. Straight or fan stream, the hazard determines which is installed. An Ansul exclusive for more effective fire control.

FIELD RECHARGING. Just 4 minutes after a fire is extinguished your Ansul unit can be recharged, ready for action. No special tools are needed.

The pictures on this page tell half a story. The complete story includes Ansul's facilities for training your personnel in the science of fire control and prevention. Experience has taught us that *complete* fire protection demands *both*—fast, dependable equipment and trained personnel to man that equipment. Ansul can provide both. Get in touch with your local Ansul man, he has the complete story about *complete* fire protection.

Call the ANSUL MAN!

Get in touch with your local Ansul man through the "yellow pages," or write direct to ANSUL CHEMICAL COMPANY, Fire Equipment Division, Dept. F-151, Marinette, Wisconsin.

Write Ansul for your copy of New Fire Equipment Catalog.

ANSUL

Phelps Dodge can make any Lead Sheath you specify!

No one type is best for all jobs!

Choosing the right lead sheath is strictly a matter of sizing up your specific job. No single type of sheath answers *all* the power cable needs of modern electric utilities.

Phelps Dodge has a wide background of practical experience in developing, testing and manufacturing lead alloys for power cable sheaths. This covers the entire range of lead alloys, including copper bearing or common lead, Habirloy (arsenical) lead or tellurium alloy lead.

Phelps Dodge makes or can make any lead sheath you want. Next time you're looking for a sheath to fit a specific application, consult Phelps Dodge.

PHELPS DODGE COPPER PRODUCTS CORPORATION

40 WALL STREET, NEW YORK 5, N. Y.

Unusual 69-KV oil-filled cable designed for Commonwealth Edison Company of Chicago. One of many Phelps Dodge cable designs with a Habirloy (arsenical) lead sheath.

Line construction bodies for light to heavy-duty. Crew compartments optional. Efficient tool compartments and drawers.

Bodies for truck driven air compressors. Designed to accommodate hose reels, tapping machines, jack hammers, etc.

Hydraulic derricks designed for front or rear mounting. Capacities to 12,000 lbs.

Mechanical Ladders expertly engineered and counterbalanced for effortless handling. Maximum heights from 23' to 40'. Swings 360°; angles to 72°.

Hydraulic jacks, controlled from rear of truck. Rigid mounted or patented Holan self-stowing types.

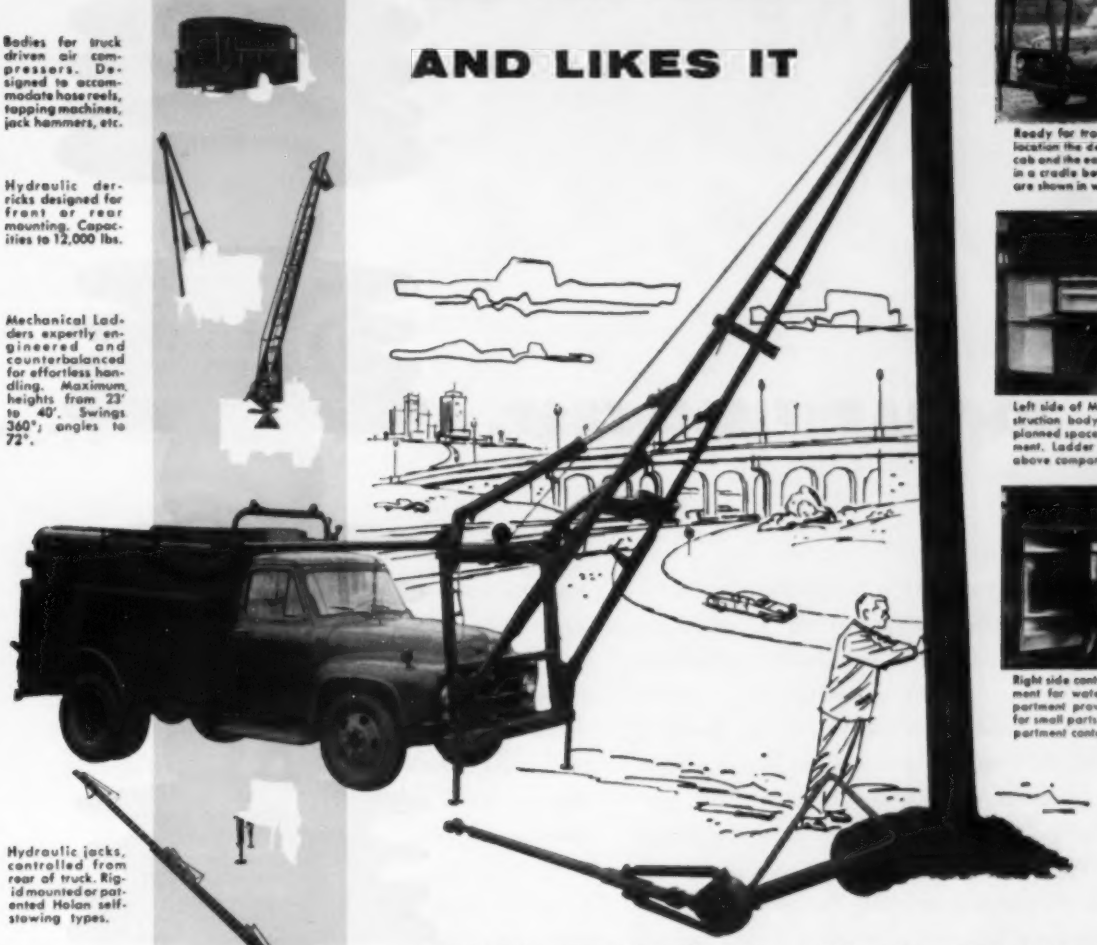
Ladders to 40' with all phases completely hydraulic. Pump actuated by P.T.O. or separate engine drive with electric starter.

Service bodies for chassis up to 1½ ton. Lengths, 75", 84", 90" and 102".

Light-duty power operated derricks for front or rear mounting. Operating range of 146°.

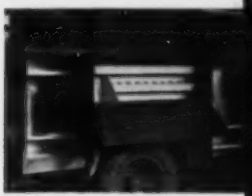
Hydraulic towers with rotary, stationary, or transverse platforms. Exclusive box-girder telescoping mast.

WORKS ALONE AND LIKES IT



Ready for transporting to the next location the derrick mounts over the cab and the earth borer sets securely in a cradle between A-frame. Jacks are shown in working position.

Left side of Model 1989 light construction body shows ample, well-planned space for tools and equipment. Ladder racks are provided above compartments.



Right side contains special compartment for water cask. Center compartment provides adjustable bins for small parts and tools. Front compartment contains rope hooks.

Almost alone, anyway! For poles up to 40 feet you can put two men to work with Holan's new mighty midget and do a crew-sized day's work!

With digger and derrick front-mounted, the man in the cab can see what he's doing as he controls all digging and lifting operations from inside. The man outside slides front jacks into place, shifts pivot pins in the derrick, guides the earth borer and swings the base of the pole into position. You can detach the digger in a flash and use the powerful HOLAN 4700 hydraulic derrick for lifting transformers and other objects weighing up to 6500 lbs.

HOLAN'S mechanized mole, Model 4401-M Mechanical Earth Borer, quickly hooks up to the P.T.O. drive shaft and is suspended from the derrick to do its work. Completely portable, the borer is lifted and secured into its cradle between the side legs of the derrick.

The HOLAN Model 1989 Body is a light line construction body adaptable to telephone, R.E.A. and other not-too-heavy electrical work. Typical Holan designing has built efficiency into every last detail from the water cask compartment to special outside shelf for a vise. Pike poles are secured on the right, ladders on the left, in rattle-free, hold-down brackets.

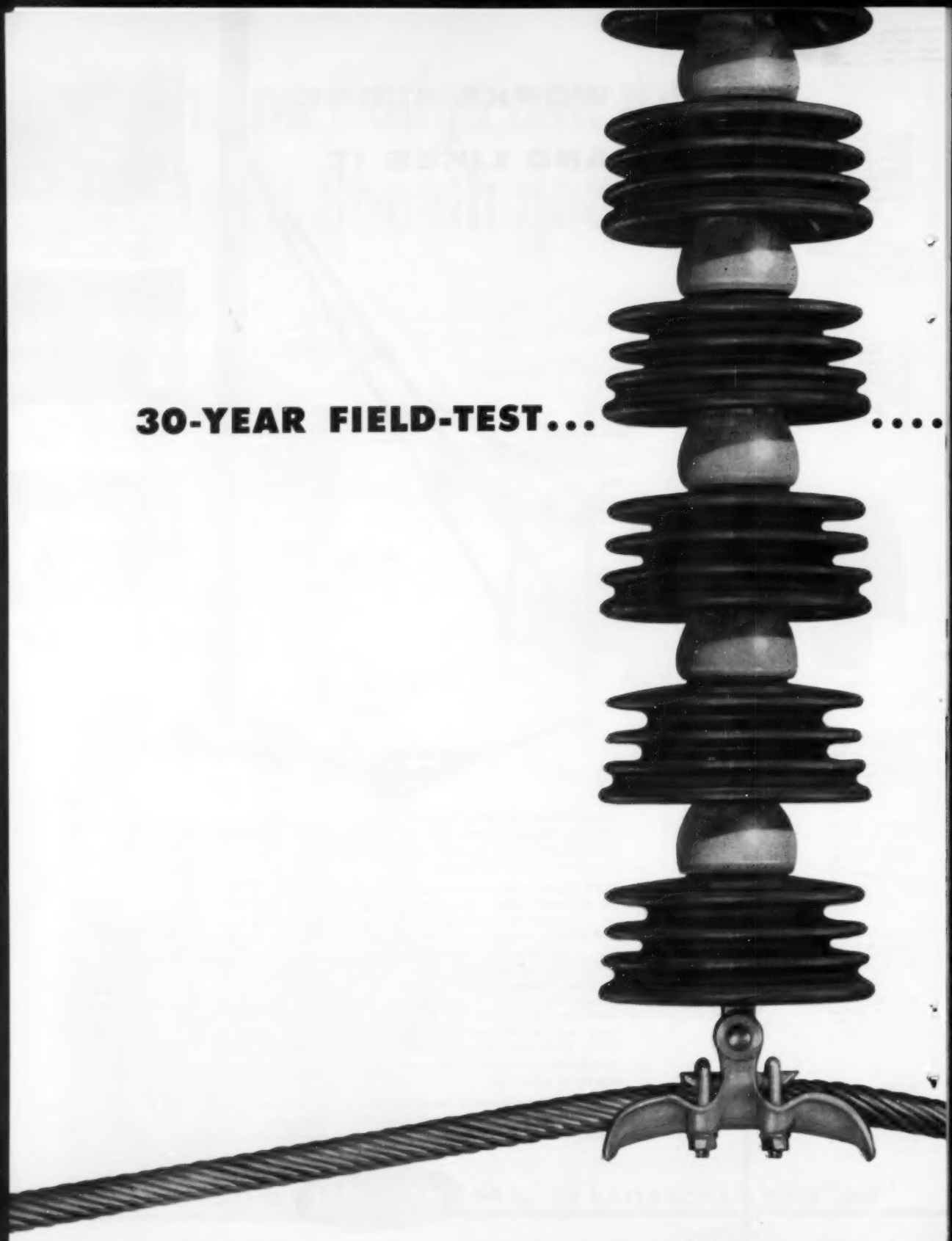
What a big difference the *right* tools make in efficiency, economy and morale. Your new HOLAN 1989 will set new goals for holes and poles! Write for more information today.

"You"-tility Engineered by J. H. HOLAN CORPORATION

4100 WEST 150 ST. • CLEVELAND 11, OHIO

THE NAME THAT MEANS WORK SIMPLIFICATION

30-YEAR FIELD-TEST...



....PROVES LAPP FOG-TYPE DESIGN

In 1924, the Lapp Fog-Type suspension insulator was designed and first put into service. The design has remained virtually unchanged for the 30 years. It is the "standard" for successful performance in dirt conditions—every "fog-type" insulator which has ever won acceptance or achieved continuity of production has been based on the same principle of multiple short petticoats providing *exposed* leakage path.

Successful application of this design principle for contamination problems has been by no means limited to suspension discs. It is a primary design consideration of the Lapp Line Post and Station Post insulators—and one basic reason for the superior operating performance of these units for line and station duty. Such fog-type surfaces have become standard, too, for high-voltage bushings, which, with nearly all of their surfaces exposed, traditionally "get by" with shorter leakage distances than are required of switch and conductor insulators in the same stations.

There are, of course, sound reasons for the superiority of the *exposed* leakage path. In the first place, it provides a *uniform* leakage path, avoids concentrated hot-spots where local stress can precipitate flashover. Also, Lapp Fog-Type corrugations are self-cleaning. A maximum of the surface area is exposed to rain and wind which flush off contamination, to increase resistance and reduce leakage current.

For transmission duty in contaminated atmosphere, Lapp Fog-Types offer a *proved* record of operating security, long life and low upkeep.

Lapp Insulator Co., Inc., Le Roy, N. Y.

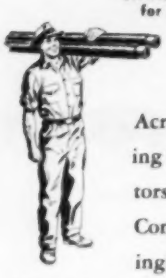
PROTECTION

FOR UNDERGROUND ELECTRICAL CABLES

STANDARD PROTECTION — for football — it's the helmet... for underground cables — it's Orangeburg Fibre Conduit.

NOCRETE for one or two ducts... installed *without* concrete encasement.

STANDARD for three or more ducts ... installed *with* concrete encasement.



Across the country in every city and state, leading Utilities, Municipalities, Electrical Contractors everywhere have made Orangeburg Fibre Conduit a leader, as its wide use convincingly shows.

You gain many advantages when you use Orangeburg. Its impermeable wall and tight joints prevent corrosive ground waters from entering. Its smooth bore and low coefficient of friction safeguard the cables when pulled in . . . also from wear during cable movement. Non-metallic Orangeburg does not corrode — resists acids, alkalies, grease, oil. It is tough, resilient, durable — will not crack or break when properly handled. And the installation cost is low because the lightweight 8-foot lengths are quickly connected by Taper-Sleeve Joints with just a few light taps. Orangeburg is easily sawed to any length — easily tooled with an inexpensive lathe.

For these and other reasons, Orangeburg is logically the leader — a first choice of so many public utilities, municipalities and electrical contractors everywhere.

Write to Dept. EW-55 for complete catalog.

ORANGEBURG MANUFACTURING CO., INC.
Orangeburg, New York — *West Coast Plant* — Newark, Calif.

ORANGEBURG® FIBRE CONDUIT

STANDARD INSTALLED WITH CONCRETE

NOCRETE INSTALLED WITHOUT CONCRETE

GraybaR ELECTRIC COMPANY

DISTRIBUTORS, ORANGEBURG FIBRE CONDUIT BRANCHES AND STOCKS IN PRINCIPAL CITIES

GENERAL ELECTRIC SUPPLY COMPANY
A DIVISION OF GENERAL ELECTRIC DISTRIBUTING CORPORATION

Pays off at the take-off!

this KEARNEY COMBINATION will speed your construction

Here's a complete "system" for making trouble-free mid-span take-offs in less time. Everything needed is made by Kearney . . . to Kearney quality standards . . . field-tested to help your crews do a better job every time.

SPAN CLAMP provides a practical and dependable way of dead-ending service wires to the bare neutral of the secondary in mid span. It is used in combination with the . . .

WEDGE-TITE CLAMP . . . easy to use and dependable because it is self-tightening. Constructed of corrosion-resistant materials throughout and plated for use on all types of conductors.

SQUEEZON CONNECTORS embody the newest developments in easy-to-install, reliable compression connectors. May be used for bi-metallic connections.

SERVICE CABLE TIES are made of soft aluminum. May be easily applied with finger pressure to secure insulated wires to the bare neutral.

AIRSEAL completely seals connections against air, moisture and any other corrosive elements. Easily kneaded on by hand . . . never hardens or cracks.

277

For Better Construction . . . Safer Maintenance

JAMES B. KEARNEY

Specify **KEARNEY PRODUCTS** *The Mark of Quality*

JAMES B. KEARNEY CORPORATION • 6234-42 CLAYTON AVENUE, ST. LOUIS 10, MISSOURI • Canadian Plant: GUELPH, ONTARIO

The latest achievement in fluorescent street lighting

FACTS about the new Westinghouse fluorescent street lighting luminaire

FACT: Top efficiency—The new 4-FSL-72 fluorescent luminaire has a large one-piece reflector and offset lamp arrangement. No physical obstructions interfere with light distribution.

FACT: Day and night eye appeal—The smooth fiber glass hood and clear plastic cover blend to produce a clean silhouette by day and a comfortable light source at night.

FACT: Easily maintained—Cover opens from either side by releasing 3 spring tension latches permitting speedy relamping and cleaning. Sponge neoprene gasket seals out bugs and moisture. Cover can be easily replaced in frame by removing 4 screws—slide out old cover—slide in new—without further adjustment.

FACT: Extremely durable—rugged fiber glass hood does not require paint. Extruded methylmethacrylate cover will not craze or discolor. Wiring is by duplex circuit so when a lamp fails, only one lamp in a reflector goes out.

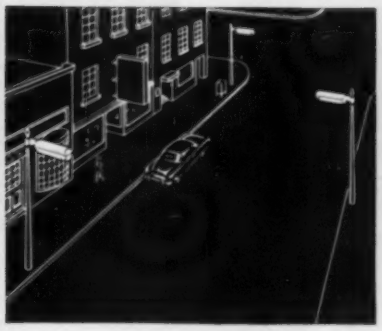
4-FSL-72 can be mounted horizontally or at any angle between 20° and 30° for different light distribution patterns.

For more FACTS see *The Man With The Facts*—your Westinghouse representative.

J-04364

YOU CAN BE SURE...IF IT'S

Westinghouse



This exciting new look in street lighting is an attractive addition to any community.

For all the benefits of fluorescent lighting—ask about the new 2-FU-72 for tunnels and underpasses.

For 14.4-Kv Service ... Tank-

ROOMY OPERATOR CABINET. Access to operator is unrestricted. Relays when specified are in separate cabinet which can be secured against unauthorized personnel. Operator is high speed solenoid type—mechanically and electrically trip-free. Side hinging of L-shaped doors allows access to operator cabinet from three sides. Only 7 inches of clearance in front of cabinet needed to open doors.

BREAKER RATINGS (8-Cycle Standard Interrupting Time)

Type	Rated Kv	Rated Amps	INTERRUPTING RATING RMS TOTAL AMPERES At Rated Volts	Maximum Rating	Kva	Weight of Breaker With Oil (lbs)
OZ-15-100	14.4	600	4,000	15,000	100,000	2,350
OZ-15-250	14.4	600	10,000	25,000	250,000	2,370
OZ-15-250	14.4	1200	10,000	25,000	250,000	2,470
OZ-23-250	23	600	6,300	12,000	250,000	2,370

A-C ALLIS-CHALMERS

ALLIS-

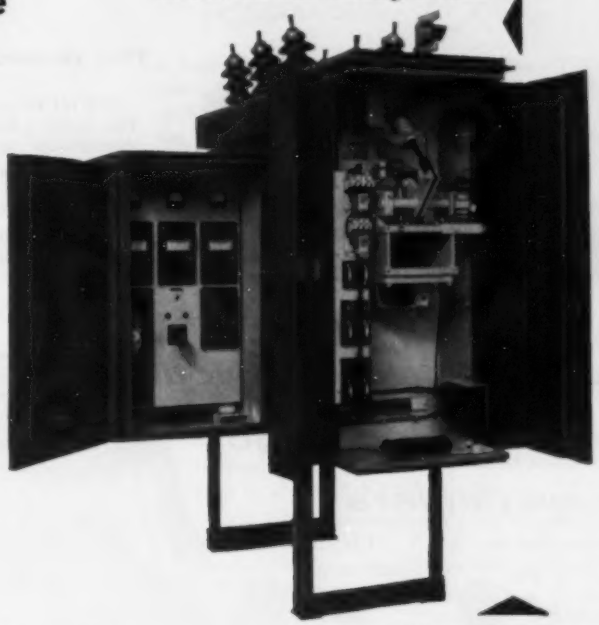
Per-Phase Design

in addition, breaker sets high standards of operating convenience

Compare this breaker with any other in its class. Note the clean design; the uncluttered operator cabinet; the accessibility to all component parts. Check the features shown below. Then, GET COMPLETE INFORMATION! Call your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4254

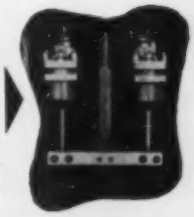
VISIBILITY PLUS — external position indicator easily visible at a distance from front or side. Contact position indicator also provided inside cabinet. In addition, maintenance closing device is side operated. Man closing breaker can observe contacts and man working on them.



RELAYS — when specified, are in separate cabinet from operator. Whether you operate the breaker — slam the door — or let the wind slam it, relay contacts will not operate accidentally. Relay panel is fixed and shock-mounted at four points. Troublesome hinge wiring eliminated. Separate door in rear of cabinet provides access to back of relays.

NO BURIED LEADS. No more conduits, pipes and fittings! To get at bushing current transformer leads, simply remove 3 pins at bottom of fabricated wiring duct and remove bottom plate. This is typical of the well-engineered features that make this breaker outstanding in its field.

DOUBLE BREAK per phase principle is used with time-proved *Ruptor* interrupting devices. Self-wiping, self-aligning tulip and bayonet contacts are used. Here again, Allis-Chalmers provides the same quality construction as is used on large A-C breakers.



Ruptor is an Allis-Chalmers trademark.

TANK-PER-PHASE construction — as used in large breakers—has high safety factor. It completely isolates phases and eliminates internal phase-to-phase flashover. A maximum of 12 gallons of oil in each tank makes it a simple matter to raise and lower tanks.

CHALMERS

Now-out of Chrysler Corporation...come the most rugged trucks ever built!

Announcing new Dodge "Job-Rated" Trucks!

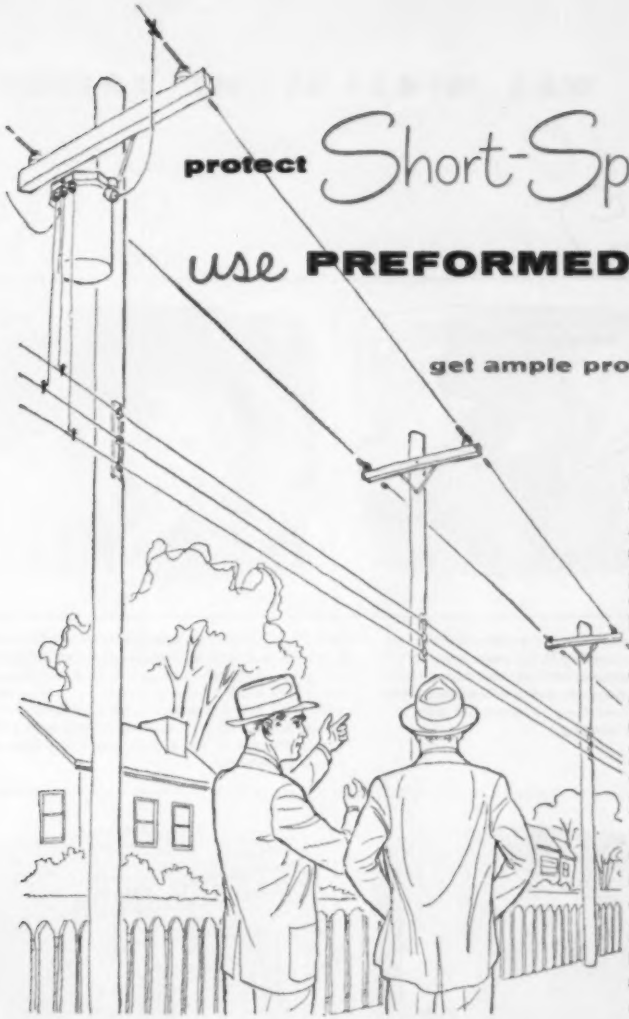
The **power line** with **full view** design!

NEW! Super Power-Dome V-8 engines—169 to 202 hp.—the world's most powerful low-tonnage V-8's—and the most dependable sixes!

NEW! Full-view design with biggest wrap-around windshield of any make! Wrap-around rear window available, too! You get greater safety, easier handling!

NEW! Higher payloads, new no-clutch transmissions, power steering and braking, fuel-saving overdrive! Plus smartly-styled interiors, colors, 2-toning! Over 100 new features!

Now on display at your dependable Dodge Truck dealer's!



protect *Short-Span* conductors

use PREFORMED LINEGUARDS*

get ample protection for urban distribution at

Reduced Cost!

● Preformed Line Guards will save money on short-span urban distribution lines . . . whether ACSR, all-aluminum, or copper conductors are in use. Use them on all conductors where protection against vibration damage is not essential and standard Armor Rods may not be needed. Line Guards are smaller in diameter —fit insulator grooves of both old and new designs.

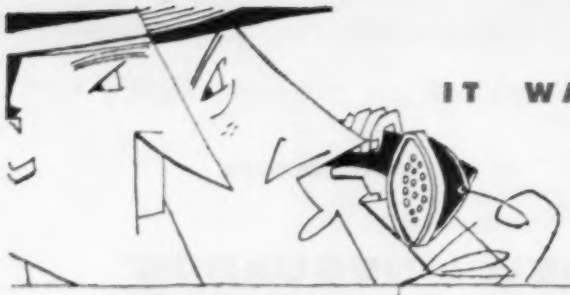
Check P L P price lists. You will notice Line Guards are *lower* in price than Armor Rods . . . yet, Line Guards provide sufficient protection on short spans.

Line Guards . . . developed from Armor Rods —are used like Armor Rods . . . protecting conductors against arcover, chafing, and mechanical wear due to concentrated stresses on light or short-span construction.

Let your P L P Representative help you select the most economical P L P Product for your application. Write or call Cleveland: EX 1-3571

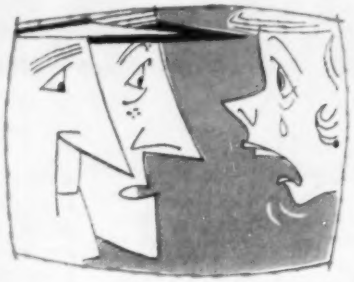
**Made in accordance with or for use under one or more of the following U. S. Patents: 2,275,019; 2,587,521; 2,609,653; 2,691,865; other patents pending.*

PREFORMED LINE PRODUCTS COMPANY
5349 St. Clair Avenue
Cleveland 3, Ohio

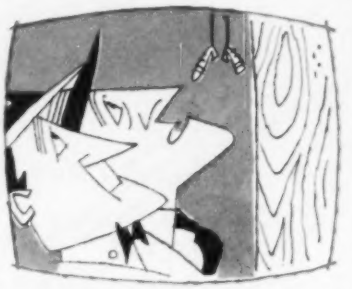


IT WAS 6:45 A. M. FRIDAY...

At 7:02 the call came through . . . *Murder*. The location . . . a fashionable new subdivision. Joe and I left immediately for the scene.



At 7:16 we arrived at the scene. A distraught housewife was standing in her yard wringing her hands. We questioned her and some of her neighbors who had begun to arrive at the scene. They all said the *same thing* . . . same old story . . . *Murder* . . . by hanging.



At 7:20 further questioning revealed the victim a familiar but unobtrusive figure in the neighborhood for years. Average type . . . same as anyone . . . got a little excited once in a while . . . a little noisy when he'd had too much . . . hard working tho . . . steady too. A little extravagant and had been called to the attention of our department a few times. No known enemies tho.

At 8:13 same old thing . . . same modus operandi . . . the same old "Peak Load" Gang, at it again. No doubt about it . . . and the victim's replacement was in danger too. Joe and I rushed back to the crime scene.

At 8:22 just in time . . . the replacement was hanging limp . . . entangled with heavy secondary busses. We cut him down . . . he'd make it. I looked at Joe . . . he looked at me . . . (bong!) where would they strike next?

At 8:34 we returned to hq. and put a check thru to D and P (Distribution and Planning) . . . we decided to fight force with force . . . no more of these losses . . . too costly . . . we put more men on the line . . . closer together. We put PTFVRS (Pole Type Feeder Voltage Regulators) at strategic spots . . . and USS's (Unit Substations) equipped to cope with local emergencies . . . we checked and decided

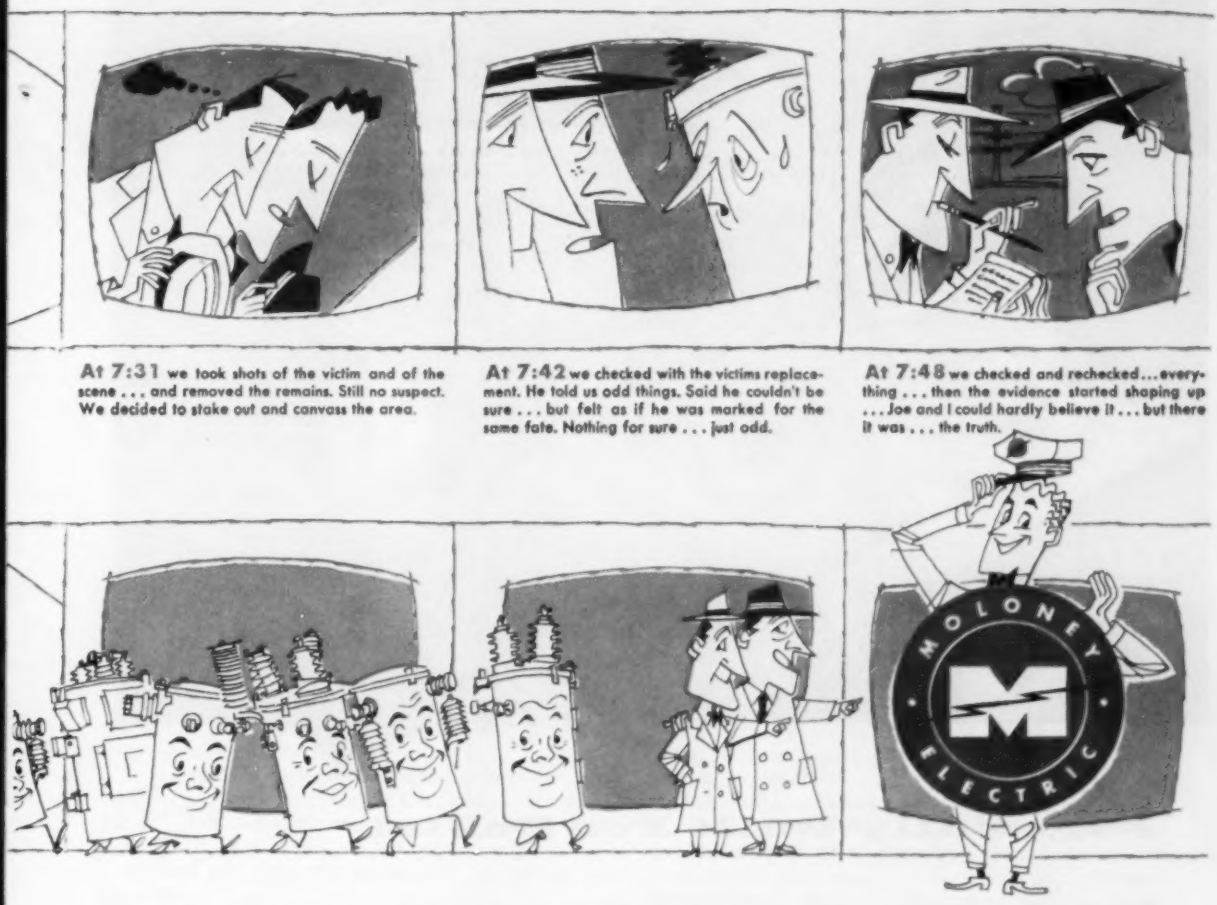
WE NEEDED THE RIGHT GUY

M O L O N E Y

Power Transformers • Distribution
Load Center Transformers • Unit Substations

SALES OFFICES IN ALL PRINCIPAL

. . . WHEN IT HAPPENED



At 7:31 we took shots of the victim and of the scene . . . and removed the remains. Still no suspect. We decided to stake out and canvass the area.

At 7:42 we checked with the victims replacement. He told us odd things. Said he couldn't be sure . . . but felt as if he was marked for the same fate. Nothing for sure . . . just odd.

At 7:48 we checked and rechecked . . . everything . . . then the evidence started shaping up . . . Joe and I could hardly believe it . . . but there it was . . . the truth.

we needed the right guy to handle the job . . . we called for Moloney.

That did it!

M333-10

TO HANDLE THE JOB . . . WE CALLED FOR MOLONEY . . . THAT DID IT!

E L E C T R I C C O M P A N Y

Transformers • Step Voltage Regulators • Regulating Transformers • Load Tap Changing Transformers
Network Transformers • Constant Current Transformers • Capacitors • Transformers for Electronics

CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

When Tutankhamen, King of Egypt, was put to his rest, it was to be forever. His was to be a permanent monument, and his body was mummified with unique skill. These burial preparations went a long way toward overcoming the destructive effects of time. King Tut's mummy still exists today—over 3,000 years after it was interred in the valley of the tombs of the kings.

Especially Built For Burial

Like King Tutankhamen's mummy, many Kerite Cables are especially built for long-time burial. But these Kerite Cables do not enjoy the favorable dry, almost air-tight conditions of King Tut's tomb. These cables must withstand all the adverse conditions encountered in direct burial in the ground from the Arctic to the Tropics. Yet when these underground cables are unearthed, even after years of service, they are, unlike King Tut, very much alive. The name Kerite is recognized, the world over, as the hallmark of endurance.

The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.

Founded 1854

KERITE CABLE

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Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco;
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EDITORIALS

New Opportunities for Economies in Grounding

There is money in grounding! Many of the dollars being spent today for plant and substation ground systems can be saved. Moreover, much of the money spent each year to investigate and repair the ravages of galvanic corrosion is spent needlessly. Means are at hand to prevent this waste. Methods have been tested and proved.

The design of station ground systems has long been an art marked by confusion of practices, occasionally bordering on witchcraft, that produced widely varying results. Today, however, mathematical analysis has revealed a way to predetermine the resistance of station ground loops, grids, and multiple rod arrangements. Coupled with knowledge of soil conditions, this kind of analysis provides designers with means of evaluating the types, arrangements, and dimensions of ground systems. It also permits them to determine which ones use materials to their best economic advantage.

Such mathematical analysis has revealed one notable conclusion: For dimensions usually found on ground systems, metallic resistance—and the material used—does not affect the results. Thus the kind of material used on ground grids, and the cross section used, can be selected on the basis of corrosion considerations, strength, and current carrying capacity.

This points the way to multiple economies: The possible use of steel in ground grids, the elimination of galvanic corrosion of dissimilar metals in the earth, ability to provide cathodic protection for the ground system and metal objects connected to it, and reductions in the cost of ground networks.

These are not mere theories. They have been proved in practice. Elsewhere in this issue is the evidence. In this series of articles you will find the mathematical analysis of ground grid designs, details of application of a steel ground grid to a 220-kv substation in Pennsylvania, and the recorded tests on this installation.

Here is proof that there is money in grounding. Here, too, is an indication of savings which will result from a re-examination of other neglected areas of utility system design.

We Told Them We Would Ask You

There is a growing concern in the industry over the terminology in everyday operations. This becomes a pretty serious matter to the people directly affected. Talking with utility men and manufacturers, we find that such factors as personal and company pride are involved. So are promotion and selling.

We've offered to carry these matters to our readers for a verdict. After all it is you who decide the everyday terminology of the industry.

What do you think:

- Is the term "boiler" or the term "steam generator" more appropriate?
- Do we need a more descriptive and more easily understandable term for "heat pump" when selling to the general public? How about "electric air" or "electric air conditioning"? Does the latter suggest only cooling?
- Which shall it be, "turbogenerator" or "turbine generator"?
- Is "adequate wiring" too stilted for general use? Would "wired for electrical living" give us more mileage or just a longer term?
- When expressing the ratings of boilers or steam generators, should this be in "boiler megawatts," "pounds of steam per hour," or "Btu per hour"? If in Btu, should it be keyed to input or output?
- In dealing with large generating units or systems, shall we express capacity in "kilowatts" or "megawatts"? Similarly, what about using "megawatt hours" instead of "kilowatt hours" when talking in big numbers?
- Which is better, "nuclear power plant" or "atomic power plant"? Surely we can't always call them "nuclear-fueled electric generating plants."

And while we're about it, we'll toss this one to you on metering practices:

- Why not read meters and bill customers in multiples of 10 kwhr? Some argue it would save reading and billing time, cut down on the need for five dial residential meters.

Let us have your opinions or suggestions on these worrisome problems. Just drop a letter to our Readers' Forum Editor, and we'll try to find space to print it. Maybe you have a pet peeve of your own along these lines. We'd like to hear about that, too.

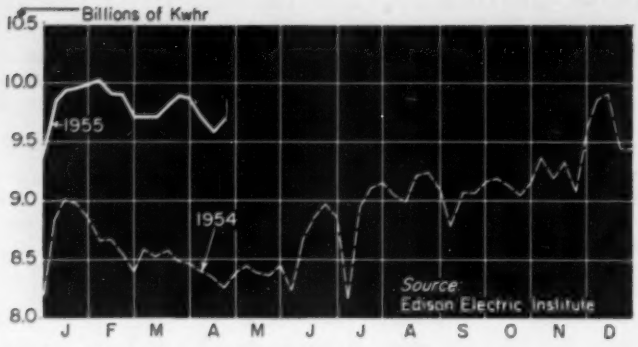
Set the Record Straight

It is a legend now at least in Tennessee that without power from the Tennessee Valley Authority this country would never have been able to produce the atomic bombs of World War II. Like the present musical legend of Davy Crockett, there is a slight exaggeration. Without detracting from the patriotism of TVA employees, we'd like to set the record straight.

Louis V. Sutton, president, Carolina Power & Light Co, told Congress last year how the first atomic production plants came to be located at Oak Ridge in the TVA service area. These factors, said Sutton, were involved in choosing the site: an isolated area which would cause the least relocation of population and contribute to the security of the plants, availability of water supply, and transportation facilities suitable for a substantial operating force.

Supply of power did not enter into it at all.

THE ELECTRICAL WEEK



OUTPUT

Week Ended Apr. 23
9,697,000,000 Kwhr
Up 17.4%

Per Cent Change from Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Apr. 23	+17.4	+11.2	+10.6	+21.1	+6.4	+26.4	+14.9	+8.4	+16.6	+12.2
Apr. 16	+15.1	+8.5	+7.4	+18.9	+4.9	+23.3	+4.7	+9.5	+14.3	+19.0
Apr. 9	+14.7	+5.6	+6.1	+17.4	+4.4	+25.0	+6.2	+14.2	+8.8	+20.5

Seasonally Adjusted Index 191.3 Week Ago 188.8 Year Ago 163.4

The Issue's News Highlights . . . Ebasco Services, Inc, is awarded contract for Dixon-Yates' MVGC plant . . . Niagara legislation splits New York public power forces . . . Administration approval is predicted for John Day Dam partnership legislation, introduced in Congress by Rep Sam Coon (R-Ore.) . . . Next legislative action on Upper Colorado River will come from House Interior Committee.

American G&E system may have a capacity of 15 million kw by decade 1970-79, according to Pres Philip Sporn. This, he told annual meeting, is based on "realistic and serious studies over a period of years." This system would require 13 million kw of new plant, and an investment of about $1.8 billion at today's costs. And "as far ahead as we can see today, the preponderance of power generated on the AGE system will be in coal-burning plants." At same time he indicated that future role of atomic energy was not being overlooked.

Cleveland Electric Illuminating has signed contract with Pittsburgh Consolidation Coal for pipeline capable of carrying 1.2 million tons of coal a year to CEI's Eastlake plant. Line, to be in operation in 18 months, will originate at the Pittsburgh Consolidation's Georgetown, Ohio, mine, and will be owned and operated by the coal company.

Santee-Cooper Public Power Authority has notified retail customers that rates will be increased 10% effective on bills rendered after April 30. Meanwhile, South Carolina legislature has named Reps Edens, McLendon, and Nicholson, and Sens Dennis, Moore, and Abrams to the committee to investigate Santee-Cooper's finances. Three other members are to be appointed by the governor.

Kansas City P&L has been granted $490,000 a year electric rate increase by Kansas Corporation Commission. This will give firm a 5% return in state . . . Ohio State House committee has approved proposal barring for two years any state employee who leaves his job from acting in any proceeding with which he was connected. Proposal is aimed at ending utility company raids on PUC personnel . . . Indiana & Michigan Electric will purchase Bloutsville, Ind., power system . . . NRECA is seeking SEC approval of $720,000 bond issue for construction of new general headquarters building in Washington.

FEI's 1955 Rate Book will be available in about a week. This edition covers changes for two-year period and includes rates effective Feb. 1, 1955. It covers residential, commercial, and industrial rates by investor-owned utilities. Book is available at $20 a copy for member companies and $30 for non-members.

NEWS OF THE INDUSTRY BRIEFLY TOLD

Off the Washington Wire . . . REA has made its first G&T loan to a new co-op under the Republicans. It approved $3.5 million for newly formed Arkansas Valley G&T to build a 16,500-kw steam plant to be lease-operated by Southern Colorado Power.

Electric & Gas Utility Accountants at Chicago convention last week were told by EEI's Pres Harold Quinton: "Top management must deal with summarized figures and is intensely interested in interpretive data and forecasts." Dr Howard Aiken, director of Harvard University's computation laboratory, said business management "must exercise leadership, with or without computers." A. P. Thompson, Iowa P&L vice president and treasurer, outlined series of "management key indicators" to aid in measuring company performance and prospects.

Personnel Changes: Maryland Utilities Association has elected George M. Nelson, president, Eastern Shore PS, president . . . Cleveland Electric Illuminating has elected as directors Cyrus Eaton, chairman, Chesapeake & Ohio Railway, and Ralph M. Besse, CEI executive vice president. Eaton was also elected director of Kansas City P&L. CEI named Alexander J. Paull vice president . . . National Farm Electrification Conference has named James R. Cobb of GM's Frigidaire Div new chairman.

TVA: Higher costs of future steam plant construction will contribute to an "inevitable" increase in TVA electric rates, says TVA Chairman Herbert D. Vogel. At same time, he said, TVA's plans for financing its own future power expansion would not itself bring appreciable increase in power rates.

Pacific NW: Puget Sound Utilities Council members must invest minimum of $670 million to provide 760,000 kw by 1963-64 if they are to meet growing demands of region, says Consulting Engineer Jack D. Stevens in report for Council . . . Washington WP has found the model of its proposed Noxon Rapids Dam (see p 50) so successful that it has ordered similarly-scaled model of its proposed Pleasant Valley hydro project . . . British Columbia Power Commission, in surprise announcement, has reversed its original stand to oppose proposed transmission line by British Columbia Electric (see p 154) to Powell River and will sell its system on Sechelt Peninsula through which the transmission line would pass to BCE for $2 million.

ABOUT PEOPLE IN THE INDUSTRY

George M. Gadsby, chairman, Utah P&L, last week told Rocky Mountain Electrical League: "Rocky Mountain region has huge uranium resources. Its utility companies, uniting with industrial partners, are analyzing available nuclear information. They are preparing cost estimates for more or less conventional power plant and hope to be among early arrivals in actual use of atomic power for peace time progress. AEC is made up of practical men who want private enterprise to take over all financial load possible."

New England G&E System expects 1955 earnings to equal or better $1.37 a share returned in 1954, Pres F. D. Campbell reports. Industrial electric sales have continued improvement through first quarter with monthly average 9% greater than 1954 monthly average, he says. Noting improved industrial diversification in New England, he cites New Bedford where payrolls of diversified industries are now over four times the textile payrolls which before war provided three-quarters of city's total payrolls.

More News About People page 146

Ebasco OK'd for MVGC Contract

- **MVGC asks SEC approval to borrow up to $120 million to build plant**
- **Attorney General Brownell cites labor racketeering at EEI's Joppa plant**
- **Former Pres Harry Truman joins attackers of Administration's power policies**

The Mississippi Valley Generating Co steam plant controversy came two steps closer to settlement last week when Ebasco Services, Inc, was officially authorized as architect-engineer and construction management contractor for the 650,000-kw project. At the same time application was made to the Securities and Exchange Commission to borrow up to $120 million to finance the construction.

As a backdrop to these highlights, the week also witnessed:

- A biting attack by Attorney General Herbert Brownell on the last Democratic Administration for allowing "hoodlums and gangsters" to grow wealthy in the labor field, and referring specifically to the experiences of Ebasco Services on the Electric Energy, Inc, job at Joppa, Ill.
- An apparent campaign on the part of MVGC foes to call for support from old public power advocates—witness the emergence from Independence, Mo., of former Pres Harry Truman to talk in Tennessee and the TVA tour of David Lilienthal, former TVA head (EW, April 25, p 14).
- A motion by MVGC before the U. S. Court of Appeals to dismiss a petition filed by the State of Tennessee and others seeking to halt construction of the proposed plant.

There had been quite an argument over MVGC's choice of Ebasco to handle construction of the new generating plant at West Memphis, Ark.

The General Accounting Office, largely staffed by personnel employed during the Roosevelt and Truman Administrations, but now under Eisenhower appointed Joseph Campbell, recently submitted a report recommending that Ebasco be prohibited from undertaking construction at the MVGC plant unless a concrete guarantee against increased costs could be advanced. The GAO also demanded restitution to EEI for losses suffered at Joppa during Ebasco's supervision.

This was settled last week. Under an agreement, Ebasco relinquished all net profit from the Joppa job. This amounted to a reduction of $2.8 million in fees Ebasco had coming from EEI.

In return, however, Ebasco got:

- Strong endorsements from the Atomic Energy Commission and Attorney General Brownell.
- Contract for the Dixon-Yates plant.

Brownell's endorsement came as he addressed the Southwestern Legal Foundation and Southern Methodist University School of Law at Dallas, Tex. He lashed out at labor racketeering generally, and pinpointed the activities of labor leaders at the Joppa plant.

Extortion at Joppa

The Attorney General charged that, until the Republicans took over two years ago, there had been "twenty years of virtual toleration by the federal government of violence and extortion in the relations between business and labor . . ."

"The lack of law enforcement in this area was an open invitation to hoodlums and gangsters to infiltrate and to capture control of the business on the one hand or of the labor organization on the other, or both . . . The interests of the public were disregarded and the legitimate interests of both labor and business were sacrificed." He cited two types of violations uncovered most frequently:

- Where a racketeer is in charge of a labor union as an official and demands a pay-off from an employer under threat of damage through strikes, slow-downs, or violent injury to the employer's property, person or family.
- Where a crooked employer induces a union official to betray and sell out the interests of his union members in return for favors.

Brownell said the construction industry in the tri-state area surrounding St. Louis was a prime example of gangster-ruled unionism. He added: "Without doubt, the most powerful racketeer in southern Illinois was Evan Dale, president of the Southern Illinois District Council of the Hodcarrier's and Common Laborer's Union.

"In December, 1954, in East St. Louis, Ill, Evan Dale . . . and an associate named James Bateman were convicted of conspiring and attempting to commit the largest extortion on record. These men had demanded the payment to them by Ebasco, as the price of labor peace, one per cent of the entire amount of the Ebasco contract to build a power plant for the United States government at Joppa, Ill. This demand amounted to $1,030,000 in cash.

"When the money was not forthcoming, Dale plagued Ebasco with 18 months of jurisdictional strikes, sabotage of equipment, violence to workers, and every conceivable kind of intimidation. The trouble was so bad and lasted so long that eventually Ebasco was forced to relinquish the contract to another firm.

"Dale's campaign of sabotage and terrorism has caused a dead loss to the United States, in the form of increased construction costs, estimated at the trial to be $51 million. But for all his boasts and all his power, Dale and Bateman were both convicted and Federal District Judge Wham imposed a sentence of 15 years imprisonment and a $10,000 fine upon each."

AEC Satisfied

The AEC felt that Ebasco's settlement with EEI was "satisfactory" and that no further reason existed to withhold approval of the firm as contractor on the MVGC plant, which will supply AEC with 600,000-kw of generating capacity for its Paducah, Ky., atom plant. AEC said settlement was "in best interests of the government", and proceeded to approve Ebasco for the West Memphis job.

In so acting, the AEC adopted the report of its own staff, which made a detailed study of the contract's provision and the role Ebasco was slated to play in the plant's construction.

That report pointed out among other things:

- No actual construction will be done by Ebasco.
- The contract board at AEC's Oak Ridge operations office recommended approval of Ebasco after a March 29-31 meeting.
- F. C. Gardner, president of Ebasco, has assured MVGC that its plant will have his personal attention during construction.
- Ebasco and its predecessor organization has been engineering and building power plants for 50 years.
- Each of the key individuals to be used on the West Memphis plant have been personally checked by top management as to their qualifications for the job.
- Ebasco has revamped its accounting and cost control procedures since the Joppa job.
- Most important in the view of the commission staff: ". . . There is an unquestioned interest on the part of Ebasco's top management to receive this assignment and to do the job sufficiently outstanding to repair whatever damage may have been suffered by Ebasco's professional reputation as the result of its performance at Joppa."

In view of these findings, the AEC commissioners felt that no end would be served through disapproval of the firm.

MVGC has taken its debt financing plans to the SEC, which has already acted favorably on the firm's equity financing plans.

MVGC has commitments from 24 banks and two insurance companies for up to $120 million in loans. MVGC will borrow $27,086,000 from banks on 3¼% notes maturing Jan. 1, 1969. It estimates it will then sell $77,362,000 worth of 3⅝% bonds to Metropolitan Life (83.8%) and New York Life (16.2%) Insurance Companies. These bonds will mature Jan. 1, 1989. The utility later may borrow the remainder of the $92,914,000 the insurance companies have offered, if it is needed. In any event, it plans to repay about $4.5 million to the banks as soon as the bonds are sold.

MVGC does not want to sell its bonds and notes by competitive bidding. Its application to SEC said: "It would not be possible to finance construction on an equally favorable basis through competitive bidding."

Still fighting the project was Walter von Tresckow, New York financial consultant, who bid unsuccessfully on the original contract. Von Tresckow suggested that the Senate-House Atomic Energy Committee again give the whole matter "a thorough airing." He charged that the company actually will receive 100 to 200% a year return on its investment—an obvious refusal to include debt financing in "investment."

And as former TVA Chairman David E. Lilienthal continued his talking tour of the TVA region, former Pres Harry Truman came down to Nashville to say the Eisenhower Administration "went into office with the objective of ruining the TVA." Without TVA, he added, "The South would never have the industrial centers it now has. There would be no such thing as rural electrification."

In a speech at Calvert City, Ky., Lilienthal said, "Some of the most patriotic people in the U. S. are being lashed by the most cowardly smear campaign in history." But at the same time he also said "The people of the Valley may find it very attractive to demand that they shall own the system they have been paying for. You already are paying off the mortgage. You may want to have an understanding that there will be a mortgage burning . . . when you pay off."

Labor leaders at EEI's Joppa plant used "every conceivable type of intimidation," and "sabotage and terrorism" that cost the U. S. $51 million

—Attorney Gen Brownell

Niagara Backers in Whirlpool

Public power forces in New York State have split wide open over the Niagara hydro issue.

Sen Herbert H. Lehman (D-N. Y.) had been trying to gain New York State and Congress support for his proposed legislation on Niagara construction and operation before introducing it in Congress on April 26. But Senator Lehman's behind-the-scenes negotiations with New York's Gov Averell Harriman and State Power Authority Chairman Robert Moses were broken off sharply April 20 after the Harriman-Moses team had a surprise bill introduced in the Congress by Chairman Charles A. Buckley (D-N.Y.) of the House Public Works Committee.

This represented a two-front defeat for Senator Lehman, despite his insistence that Buckley will come around to his way of thinking after House committee hearings get started, probably not until late in May.

First, Lehman had been counting on Buckley to co-sponsor his bill—to have the state build the $405 million project and market it with purchase preference for public agencies—in the House. Since Buckley's committee would handle it, that would be a real advantage.

Second, the Buckley bill falls far short of what public power forces think of as necessary "safeguards." It has a new type of preference. It lets the Federal Power Commission pick the Niagara licensee, as preferred by the Bureau of the Budget. It permits the licensee to build transmission lines, but does not require it. It adds to the cost of the hydro project the $11 million remedial works job now being done and paid for by the Army Corps of Engineers.

The Lehman bill, which would require the state to build, acquire or

contract for transmission lines, is close to the one he sponsored in the last session of Congress. The House sponsor is Rep Irwin D. Davidson, the Democrat who took the place of Senator Lehman's past co-author, Franklin D. Roosevelt, Jr.

Supporters of private-enterprise construction of the Niagara project still rally behind legislation sponsored by Rep William E. Miller (R-N.Y.) and Sen Homer Capehart (R-Ind.) despite apparent Administration opposition. They are hostile to the Lehman-Davidson and the Buckley bills, as well as to a lightly regarded measure to have the Army Engineers construct the hydro works and then turn it over to some one else, sponsored by Rep Edmund P. Radwan (R-N.Y.).

The Buckley bill caught Senator Lehman completely unaware. The measure actually was one of a series of compromises in the negotiations, at which time Moses figured he had gone far enough along the public power path and urged introduction of legislation.

Mayor Robert F. Wagner of New York City, is in the Lehman corner on this one. He is known to be dissatisfied with Governor Harriman's handling of the power question since the Democrats took over the state administration. Particularly galling was Harriman's reappointment of 73-year-old William Wilson to the NYSPA.

This eliminates any chance of the Democrats' gaining a majority on the state power unit until the spring of 1957. Only Democrat now is public power advocate Charles Poletti.

The Lehman-Harriman split covers another key field: State construction of transmission lines. The senator thinks legislation, state or federal, is necessary to make the power clear. The governor says the state can build them under present state law.

To Spend $22 Million

Cleveland Electric Illuminating Co has revealed plans to spend more than $22 million for expansion of facilities in Lake County. Plans include addition of a new $20 million generator at the Eastlake power plant; $1.7 million transmission substation at Fairport-Nursery Road in Painesville Township; $287,000 substation in Mentor Township; and $275,000 power unit at Perry Township.

Commonwealth Puts New Unit in Service

First 160,000-kw generating unit of Commonwealth Edison Co's new Will County Station (shown above) has been placed in service. The station is on the Chicago Sanitary Ship Canal near Lemont, Ill.

The new coal-burning plant, located between Commonwealth Edison's Ridgeland and Joliet stations, will feed its output into the company's transmission system which interconnects generating and bulk-power units. Another 160,000-kw generator will be added to the station this summer and a third, with 250,000-kw capacity, is scheduled for completion in 1957.

WASHINGTON CHECKLIST

Fryingpan-Arkansas—Senate subcommittee approved bill (S 300) authorizing the federal project.

Southwest Power—Congressional action was completed (conference report was adopted) on appropriations bill giving Southwestern Power Administration $400,000 to continue interim power contracts for remainder of fiscal 1955.

REA Funds—Senate committee reported bill to amend Rural Electrification Administration state allotment formula (Senate report 209).

Hells Canyon—Senate committee announced beginning of hearings May 2, 3 and 4. Twenty-six senators appealed to Federal Power Commission to hold hearings on Idaho Power Co's application in abeyance until Congress completes action on the high dam bill (S 1333).

REA Loans—Boone County Rural Electric Membership Corp of Lebanon, Ind., gave REA a check for $18,543 in full payment of a $567,926 loan.

Cost Allocation—Rep James W. Trimble (D-Ark.) said he would introduce legislation to set up a guide for Army Corps of Engineers' and Reclamation Bureau's benefit-cost ratio determinations.

Small Projects—House subcommittee approved bill (HR 104) providing for federal government participation in non-federal reclamation projects.

Black Butte Dam—Rep John E. Moss (D-Calif.) said he would ask $100,000 for Army Corps of Engineers' study.

NRECA—Charles J. Fain, former National Rural Electric Cooperative Association legislative assistant, is now assistant general manager of the co-op organization. Richard Dell, former head of REA's Telephone Loans Division, succeeds him. NRECA Executive Manager Clyde Ellis' title has been changed to general manager. Changes were recommended by Rogers, Slade, & Hill, a management firm retained by NRECA.

Ike's OK on John Day Expected

- **Army Engineers will construct and operate entire project**
- **Participating companies will finance 88% of total cost**

The Eisenhower Administration is expected to officially endorse within the next few weeks, Rep Sam Coon's new partnership power program for John Day Dam on the Columbia River in Oregon (EW, April 25, p 10).

The Interior Department completed a report on the bill (HR 5789) a few days after it was introduced in Congress. The report will be submitted to the Budget Bureau. White House approval is certain.

Coon, an Oregon Republican, prepared a section-by-section analysis of his bill (Congressional Record, April 21, pp 4174-77), which shows how local Oregon-area utilities' plan to finance construction and operation of the power features of the 1.1 million-kw project.

Outstanding features of the John Day plan are:

- The Army Corps of Engineers would design, build, and operate the John Day Dam as a part of its overall plan for development of the Columbia River. The Corps is already authorized to build the project under a five-year-old law which endorsed the Engineers' plan (House Document 531, 81st Congress, June 28, 1949) for flood control and navigation works at the site.
- Eighty-eight per cent of the money—$273 million, according to present estimates—for the $310 million project would be put up by Oregon utilities, municipalities, public power districts, and other power distributors. They would share in the dam's power output to the extent they contributed toward its construction. The government would finance those costs allocated to flood control, navigation, and other nonpower features.
- Costs could vary somewhat, so Portland General Electric Co, Pacific Power & Light Co, and Washington Water Power Co—the three Northwest utilities now pushing the plan—are willing to raise more than $273 million if necessary. The legislation as written provides that they increase their share to cover added costs until the axis of the dam has been established. The companies figure that after this has been done, only unusual circumstances would cause cost estimates to change radically.
- The companies also agree to pay cost of maintenance, replacements to power facilities, operation of the dam's power features, and interest during construction.
- In case of any future additions to the dam's initial installation of 13 generators, each rated at 85,000 kw, participating local organizations which contribute toward their procurement would share in added power output.
- HR 5789 would recognize the John Day Project as essentially a navigation project so far as a proper constitutional federal interest is concerned, rather than as a flood control project. It would also authorize a pool elevation of up to 265 ft, rather than the 295 ft envisioned in the earlier plan, to protect upstream communities.
- Applications of local power organizations which want to share in John Day power output would have to be submitted to the Federal Power Commission. The bill lays out standards to guide FPC in allocating the power if applications exceed the supply. Applicants have six months to apply, and FPC would allocate both cost participation and power shares among those who qualify on the basis of their present and future supplies from John Day and other sources, the benefits of John Day power to the areas they serve, and their financial stability.
- Qualifying distributors would also be required to obtain 50-year contracts from the Interior Department. These would provide for extra payments for energy transmitted over federal lines, charges under law for up-

Delzell Speaks Up for John Day

Thomas W. Delzell, board chairman and executive head of Portland General Electric Co, one of the companies participating in the John Day partnership project as proposed by Rep Sam Coon, was recently interviewed by an Electrical World correspondent.

The three participating companies, Delzell said, "already had reached base" with financing houses, principally insurance companies, for any portion or all of the cost of the power phases of John Day.

He declined to publicize specific terms but declared that the financing arrangements were unique, providing funds on a "standby basis" for use as the construction advances and at an interest rate which would permit sale of the energy "competitive with any other wholesale rate in the area by the time this (John Day) is ready."

Speaking for the three companies, Delzell said, "We can use all of the power ourselves—but are willing to accept partners. The bill is wide open—any agency can come in."

In a joint statement, Delzell for PGE, Washington Water Power Co President Kinsey M. Robinson, and Pacific Power & Light Co President Paul B. McKee announced, "The proposed legislation offers a sensible and practical method of getting John Day built quickly in conformance with the comprehensive Columbia River development plan of the Army Corps of Engineers to help meet urgent power needs of the Pacific Northwest and improve navigation.

"It is definitely understood that participation in the plan is open to any electric system, public or private, that is ready and willing to advance funds to help get the project built. Each participant would share proportionately in the power produced at the dam during the pay-out period.

"If necessary, the companies we represent are willing to undertake to put up the full $273 million needed for the power development. It should be made clear, however, that the amount of power we (the companies) may obtain would depend entirely upon the volume of applications made to the Federal Power Commission by other responsible utilities seeking to participate in the program."

stream or downstream power benefits.

The $310-million estimate of costs for John Day was based on current firm estimates of the costs of McNary and The Dalles Dams. The Dalles, 25 miles downstream from the John Day site, will cost a total of about $300 million. McNary, 75 miles upstream, will cost about $287 million. The bill's backers believe the $310 million estimated for John Day may be conservative, "especially in view of the economies in construction that could probably be effected by having substantially all of the funds necessary to construct the project at the time work is commenced, rather than having to slow down construction because of delays in appropriating funds, as is usually the case where full federal payment is involved."

It is hoped authorization will be forthcoming next year. To speed succeeding developments, the bill provides that contracts for payment of funds and sale of power must be entered into within two years from the date of enactment of the bill, or within a year after the engineering planning is completed, or a year after issuance of certificates by FPC, whichever comes later. If things should go too slowly for this timetable, the Engineers would be authorized to go ahead on their own, without regard to the partnership proposal.

Possible Participant

Congressman Coon had included the Eugene (Ore.) Water & Electric Board among the agencies offering to advance the costs, but later that day Board Superintendent Ray D. Bowles denied this. He said that if the municipal system is unable to get new energy resources via Cougar or Beaver Marsh proposals, the city might become a John Day applicant.

The companies reported they were assuming that the four Washington and Oregon PUD's, which had indicated last year they would join in the John Day proposal, were still desirous of participating. There were doubts about this, however. The same day, the Northwest Public Power Association adopted at its Eugene, Ore., convention a resolution calling for federal construction of the John Day Dam, noting there were fewer obstacles to this than any other project proposal. NPPA officials said they would discourage public agency participation.

House Gets Upper Colorado

Next legislative action will come from House Interior Committee. Full committee schedule may delay issue until June

Senate passage of the $1.5-billion Upper Colorado storage legislation has turned the spotlight on the House Interior Committee for the next development on the Administration's biggest package of natural resources legislation.

The House irrigation and reclamation subcommittee has finished open hearings on the legislation, but there is little chance of it getting down to consideration of the bill in executive session until June. The Interior subcommittees have a full schedule until that time, and since almost every member of the full committee sits as a member of the subcommittee, no action can be taken until the committee gets some free time to schedule executive sessions.

Echo Park Controversy

This committee is where the legislation ran into trouble last year and was reported out by a bare 13 to 12 vote after 14 days in executive session —only to be turned down in the House because of the controversial Echo Park feature.

This year Echo Park is just as controversial—opposed both by conservationists and southern California congressmen—and prospects are that the subcommittee can look forward to another 14 days of trying to write a satisfactory bill.

Chairman Clair Engle (D-Calif.) already has served notice that he will oppose Echo Park because he doesn't think the House will accept it and that to leave it in the bill might jeopardize the entire legislation.

At this point, the projects that stand the best chance of staying in the House bill are the mammoth Glen Canyon Dam and power project and the 11 participating projects, all approved by the Interior Department.

Projects added last year by House or Senate committees that stand next best chance of being included are the Flaming Gorge reservoir and power dam on the Green River above the proposed Echo Park site. And the Curecanti project in Black Canyon on the Gunnison River in Colorado.

The Senate struck out the Cross Mountain Project on the Yampa River in Colorado—a companion project to the Flaming Gorge—and substituted the smaller Junniper Project. The House is almost sure to drop Junniper, but there is some question on restoring Cross Mountain.

There is a growing feeling among proponents of the project that it may be better to take what can be gotten through Congress this year without a knock-down fight, in order to get the project started, than to risk having the entire legislation blocked because of some controversial features.

Meanwhile the House Interior subcommittee on irrigation and reclamation is pushing ahead on authorizing legislation for the $220-million Trinity River Project in California. Pacific Gas & Electric Co of California has made a bid to buy the falling water and develop the power from the project, thus turning it into a partnership project. Mood of the committee is to push authorization as a federal project, leaving authority to Secretary of Interior to work out a partnership arrangement with PG&E, subject to approval of the committee.

BPA's Industrial Users Continue on Cut Quota

Industrial customers of Bonneville Power Administration continued on a 25% of normal quota of interruptible load demand the week beginning April 17 and there appeared no chance the 14 plants could expect relief.

Rains had helped streamflows the two weeks previous, suggesting a let-up of the curtailment was in the offing, but by April 15 temperatures dipped in the Upper Columbia River watershed leveling off the inflow at Grand Coulee reservoir while at the same time boosting demand in the region.

In an appraisal released April 18, BPA doubted streamflows would permit increments in the interruptible energy deliveries before another week. Hungry Horse drawdown was used for peaking to conserve supplies.

Interview with New A-C President

Stevenson Stresses Atom's Future

For sometime, he said, "Allis-Chalmers has been interested in atomic research for power generation . . . A-C is deeply interested in . . . the boiling water reactor and the breeder reactor. The breeder reactor particularly appears to offer possibilities for large scale power plants."

Heavy accent was laid on stepped-up development of nuclear energy as "a major power source" by Robert S. Stevenson in an exclusive interview with an Electrical World editor two days after he had assumed top executive post at Allis-Chalmers Manufacturing Co.

As executive vice president for two years before succeeding the late W. A. Roberts as president, Stevenson had been in charge of exploring the future of atomic energy in its relation to his company's products and operation.

"Atomic power," Stevenson declared in his interview with EW, "appears to have great possibilities. We are now seeing the fastest development of a major power source the world has ever known . . . Allis-Chalmers is not looking the other way while this is going on."

Stevenson commented that, under his direction, the company would continue the plans and policies which were in effect at the time he took over the presidency. A-C's interest in the atom, he said, was nothing new. The company is a member of Atomic Power Development Associates.

Stevenson mentioned that the company has been looking into "the possibility of getting into the reactor business. . . ." However, he added, "At present we think it is possible that we many not build reactors themselves."

Stevenson joined Allis-Chalmers as a tractor salesman 22 years ago. Working his way up in the Tractor Division, he was then made vice-president in charge of the division in 1951.

Utility Relocation Cost Studied

The Senate roads subcommittee handling the new highway program is considering demands of private electric utilities that the federal government and the states pick up the bill for required utility relocation.

Witnesses from electric utilities and telephone companies pleaded that relocation costs are going up, and so the general public that will use the new highways should bear the relocation costs.

The Bureau of Public Roads, in a new report, substantiated the argument that relocation costs are increasing. A survey, just out, shows that in 1953 utilities relocation costs amounted to more than 2.5% of the $1.7 billion spent in road building.

Cost of relocation reported by utilities for 1953 totalled $35.5 million, of which $8.5 million was reimbursed. Adding estimates to take account of companies that did not report, the total would go up to at least $45 million, or 2.6% of the highway construction cost. Privately owned utilities bore the greatest burden.

Electric power and telephone systems accounted for nearly 70% of the $35.5 million relocation cost reported by the utilities for state highway projects in 1953. Power system changes came close to $12.5 million, with the electric utilities paying more than $9.5 million of the bill. The telephone companies carried a bigger load, paying more than $10 million of costs that approached $12 million.

Gas companies, too, put up a larger share of nearly $5 million for relocations of their facilities. Their reimbursement was slightly less than $1 million. Water systems, most of them publicly owned, fared better. They got back nearly $1.6 million of $3.8 million expended on relocations.

Sewage facilities, other pipe lines, telegraph lines and transit systems make up the rest of the $35.5 million relocation total. The transit lines get the best break. They recovered $900,000 of $1.1 million spent.

Full reimbursement is almost universal for utilities that occupy their own right-of-way. The utilities pay all or part of the cost only where they enjoy franchise or easement privileges on highway right-of-way.

Of $29 million spent for relocations on highway right-of-way, the utilities recovered less than $4 million. But of an expenditure, some less than $6.5 million, on private right-of-way, they got back $4.6 million. BPR wonders why the latter reimbursement wasn't for the full amount, unless the difference represents betterments that aren't entitled to compensation.

BPR's $1.7 billion highway construction figure includes more than 10,000 projects on 40,000 miles of road. The reporting utilities identified some 5,400 relocations on about 3,800 of these projects, involving nearly 14,000 miles of highway.

Compared with the total program, the utility relocation cost was $888 per mile. Limiting the comparison to the 3,836 projects requiring relocations, cost was $2,562 per mile.

Huge 310,000-kw Elrama station is big jump from original one-dynamo operation . . .

Duquesne Light Marks 75th Year

As company prepares to operate first full scale nuclear power plant in U. S., Chairman Philip A. Fleger notes that 75 years ago people ridiculed electricity

From arc lamp to atom power in 75 years—this describes the history of Duquesne Light Co which recently celebrated the 75th anniversary of its founding.

When a group of Pittsburgh business men took out a charter on March 6, 1880, for the district's first power and light utility under the name Allegheny County Light Co, they were embarking on a daring venture. Demonstration at a local exposition in 1877 of a small arc machine led them to believe they could provide the city with electric light. They did.

Seventy-four years later, that same pioneering spirit was to show up when Duquesne, successor to the original Allegheny County Light, became the first private utility in the United States to undertake construction of a nuclear power plant.

Today, when millions of dollars are required to start a new generating plant; with millions of electric lights glowing in home, factory, office, and on street; and with electricity powering many different everyday operations, Duquesne can look back to a start which was virtually a basement operation—one 40-light dynamo.

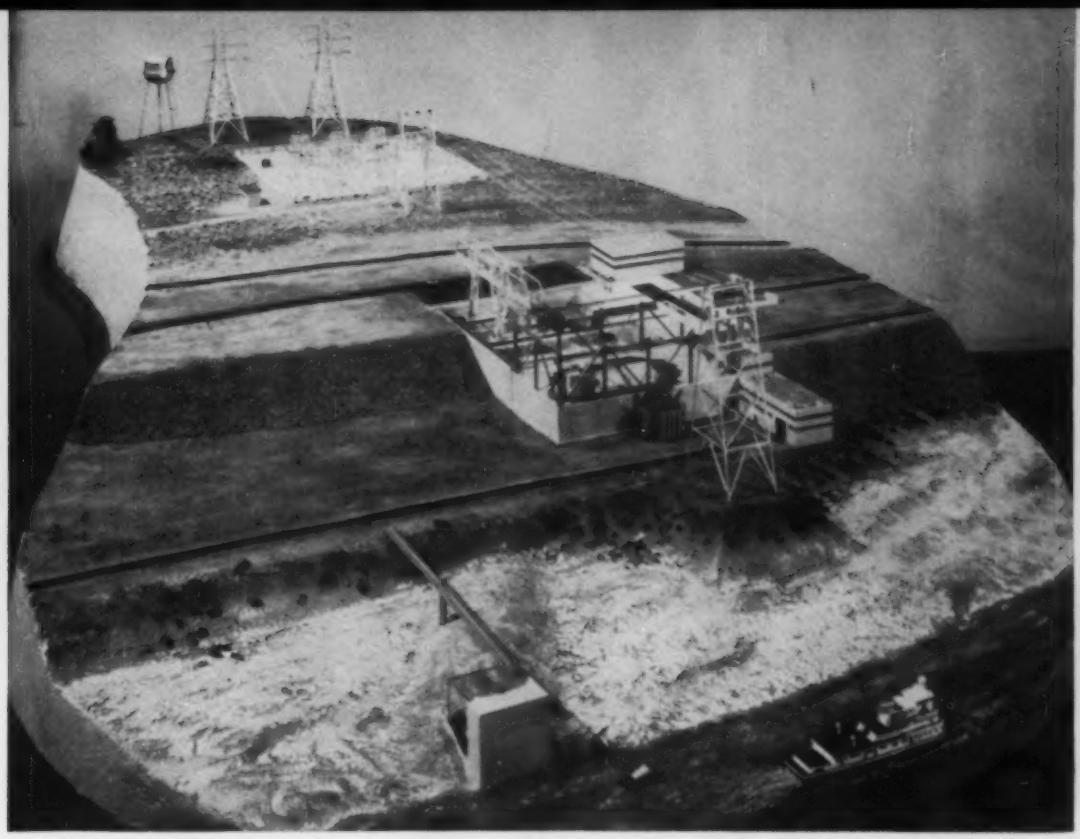
The dynamo was Allegheny's sole initial investment because it was run off the machinery at the Westinghouse Machine Co in the evenings. Factories were operated only during the day then, and electricity was required only for night lighting.

Demand for lights increased so rapidly that within a few months there were ten 40-light machines in operation. Machines were rated then by the number of arc lights they could supply as the energy was used almost exclusively for arc lighting.

Several of these machines were at the company's first permanent power station in Virgin Alley (now Oliver Avenue). The machinery consisted of Munroe boilers, Westinghouse standard engines, and Brush arc machines.

The growing popularity of electric lights also resulted in a growing number of competing companies for Allegheny. Over the years, by consolidation and merger, these companies finally grew into today's Duquesne Light.

The first dynamo has given way to plant now representing over $378.7 million; a system serving 387,662 residential, 45,424 commercial, and 1,590 industrial and other customers; a total generating capacity of over one million kw; and a service area of 817 square miles. The company's construction program this year alone will total $35 million.



But Shippingport atomic power plant represents seven-league stride into future

and Ties Its Future to the Atom

The original Virgin Alley plant has been replaced by the following plants: Brunot Island (116,500 kw), James H. Reed (180,000 kw), Stanwix (5,000 kw), Colfax (262,-500 kw), Elrama (310,000 kw), and Frank R. Phillips (190,000 kw).

Duquesne's development has been marked through the years by close cooperation with Westinghouse Electric Corp. This cooperation grows out of George Westinghouse's initial help and interest in Allegheny County Light Co's infancy.

The past 75 years of Duquesne's history reveal a number of interesting developments, many of them pioneering:

- Billing early arc light customers in accordance with the number of lamps used in any one evening (the early arcs only lasted one evening, and there were no meters).
- Adoption of the Shallenberger-Westinghouse ampere-hour meter, invented in 1888, which for the first time permitted charging the customer for just the amount of electricity he used.
- Cooperation with Westinghouse and other manufacturers at various times on such pioneering ventures as: use of alternating current with incandescent electric lights; development of what may have been the first high tension (66,000 v) ring to surround a metropolitan area; testing oil circuit breakers at full capacity; working out a design for automatic tie-line control equipment; development of parallel operation on interconnections; and others.

But the high point of this history is the agreement concluded last year with the Atomic Energy Commission to undertake, in cooperation with Westinghouse, construction of country's first full-scale atomic power plant.

To be built at Shippingport, Pa., this station will have 100,000-kw capability which will be tied directly into the company's system. It will differ from the conventional power station only in that the conventional boiler and associated equipment will be replaced by an atomic reactor and heat exchangers.

The government, through Westinghouse, will design and construct the reactor portion of the station, with Duquesne participating in design and construction. The company will construct at its own expense the turbine generator and the transmission facilities.

The company will own all of the station other than the reactor portion which will be owned by the government.

And, as Duquesne pioneers in this new phase of electric power generation, Chairman Philip A. Fleger notes:

"Some new and exciting developments are in store for the users of electricity. Transluscent walls coated with fluorescent phosphors will illuminate the entire home of tomorrow. Ultra-sonic waves shot through soapy water may wash clothes instantaneously, and high frequency radiation may dry them just as quickly. Entire meals may be cooked right at the table in less than 60 seconds by radio frequency heating."

To Study Construction Cost Savings . . .

Washington Water Power Co is using a working scale model to study construction of its Noxon Rapids hydroelectric project.

The $85-million project will consist of an earth-filled dam with concrete spillway and intake (non-overflow) sections. The powerhouse at the toe of the dam will have four turbines each rated at 128,200 hp operating under a mean net head of 150 ft. Each will drive an 82,000-kw generator. Provision will be made to add a fifth generating unit.

The hydraulic model of the dam and of 3,000 ft of the Clark Fork River site in Sanders County in northwestern Montana is located in a quonset hut on the Washington State College campus about 80 miles south of WWP's headquarters in Spokane.

Preliminary studies with the model already have saved the company thousands of dollars by indicating changes in guidewall design. Step-by-step construction on the model follows the pattern expected to be used in building the actual $85 million project.

Usefulness of the model is unlimited. William A. Hill, WWP structural and hydraulic engineer, explains the company "gets a good deal of information on behavior of the river from the prototype that can't be derived by computation."

The model helps determine the height of the cofferdams, the amount of channel excavation, and size of water passages. It can show what will happen under flood conditions—"something you never can be sure about at the project until it happens," Hill points out.

WWP used a smaller model, built by Worcester Institute of Technology in Massachusetts, in constructing Cabinet Gorge Dam 23 miles downstream from Noxon Rapids. The studies resulted, among other things, in erection of a retainer wall to prevent flood damage to the powerhouse. The wall had not been included in original plans.

With the decision to build the Noxon Rapids Project, Pres Kinsey M. Robinson and company engineers agreed they needed a model. Because they wanted it closer than Massachusetts, they approached the division of industrial research of the Washington State College, Pullman. Agreement was reached wherein the college went into the model business—its first venture into this field. But college directors hope this initial venture will lead to the establishment of a model laboratory and a new service for utilities of the Pacific Northwest.

Built to a scale of 1 in. to 50 ft, the Noxon Rapids model is on a bigger scale than the Worcester model (1 in. to 60 ft). It is built to the largest scale ever employed for a project model for either private or federal use in the Pacific Northwest.

WWP Uses Noxon Rapids Dam Model

The model was built from cross-section surveys of the Montana site by Ebasco Services, Inc, design engineers on the project. Steel templates, cut to duplicate cross-sections of the natural topography, were installed every foot on model and spaces filled with sand.

Detailing of the topography was done by hand-molding vermiculite-aggregate concrete. Except for trees, the miniature duplicates the Noxon Rapids terrain and flow extending for 3,000 ft along the river on both sides of the rapids.

The Clark Fork River splits into two channels at Noxon Rapids with an island in the center. The $85-million project will be built in two sections across the channels. Earth-filled cofferdams will block the east channel while the spillway section of the dam is built. Later, three cofferdams will close the west channel while the powerhouse section is under construction.

WWP's engineers plan to use the model to check capacity of the spillway gates as presently designed to see if they will handle maximum flow. The model also will provide a check on erosional effects on the earthfill wing dams that will be constructed at each end of the concrete dam.

"The model will provide an additional check on capacity of the spillway gates at maximum flow," points out Hill, and doubtless will "dictate spillway gate opening sequence." Water flow over the model site can be controlled from zero to a volume representing river flow that exceeds any flood on record. A flow of 15 cfs in the model represents a river flow of 265,000 cfs.

Already the incomplete model indicates the utility must build a long guidewall downstream from the rapids site and deepen the channel to control flow during early construction. The wall will control eddys backing around the island during powerhouse construction. The company hopes to begin work at the Montana site in April, pending a license from FPC. The 350,000-kw project would produce the first power from its five turbines in 1959.

Engineers E. Roy Tinney and Paul Ruff of WSC's industrial research division are in charge of the model construction. Prof Charles L. Barker directs the hydraulic section of the division. Early studies will cover river diversion, excavation, rate of opening and closing spillway and tainter gates, and guidewall location.

Once these are completed, the finished model will prove out a theory that WWP's engineers have reached by computation. That is, says Hill, that backwater from Cabinet Gorge, reaching to the tailrace of Noxon Rapids, will increase the effective depth of the entire section of river harnessed by WWP.

When they saw a 1,500-lb ingot hit 2,200F in an hour, steelmen knew that . . .

West Penn Sells Induction Heat to

FREDERIC F. DICKMANN, Manager of Industrial Sales, West Penn Power Co, Pittsburgh, Pa.*

As selling costs have climbed during the past few years, we have all realized that we must increase our sales effectiveness. One way to do this is to make sales presentations to groups of people instead of individuals. Obviously in industrial sales this opportunity is limited. But where there are a number of prospects within a reasonable distance, group selling may be the answer.

Certainly, you can afford to prepare a more elaborate sales presentation for 50 prospects than for one. Possibly you can even afford a dramatic demonstration for such a group and thus be far more effective than if you talked individually with each of the 50 prospects for half a day in his own office.

Group-selling is not new. We at West Penn have tried it many times in recent years. Some of our tries were successful, and some were not. We were so bad on one occasion that only one customer attended our meeting. We would have felt better if he had stayed away too.

Practice Is Required . . . Over the years, however, we have learned much about conducting successful industrial group selling activities, and we are still learning. We attempted our most ambitious promotion of this nature some time ago and attained exceptionally good results. Here is how we planned and executed it and what we believe made it successful. The promotion was our 60-cycle Induction Heating Clinic at Uniontown, Pa.

In the area served by West Penn Power Co, the largest segment of industrial revenue comes from the basic steel producers—mills turning out tonnage steel in the form of bars, sheet, strip, rods and wire. To roll ingots to these forms, the steel must be heated to about 2,200F. Often it must be reheated between reduction operations.

Until recently, very little study had been given to the possibility of electrically heating steel for rolling, even though the market is enormous. (Thirty billion kilowatt hours would be required to heat to rolling or forging temperature all the steel produced in the United States in 1953.)

Natural gas is now used where available. In our area the purchaser can obtain six times as many Btu's for his dollar as for his electric dollar. Despite this we had found our customers growing more and more interested in electric heat. They were looking for ways to heat steel without forming scale on its surface, for ways to prevent decarbonization, and for better control methods.

The Time Was Ripe . . . Obviously the time was ripe for the promotion of methods for heating steel electrically. We believed the answer was 60-cycle induction heating. But to our knowledge, no one had ever successfully heated large pieces of steel to rolling

*Adapted from a speech presented before the Pennsylvania Electric Association's Industrial Sales Conference, Skytop, Pa.

• "Sell 'em in bunches" is the philosophy of West Penn Power Co, which has found through experience that a dramatic show is often better than the vivid words of its persuasive salesmen

. . . induction heating could speed mass production

Steelmen En Masse

temperatures by using this method.

However, we found the General Engineering Co of Toronto, Ont., as enthusiastic as we over the possibilities. This company was willing to collaborate by furnishing induction coils for experiments and demonstrations. A recently vacated trolley barn beside our Uniontown substation provided ample room and power.

So much for the background. In retrospect, we find that our steps to successful promotion were these:

1. We tested our customers interest. Our power engineers discussed the subject with them. We described the possibilities of 60-cycle induction heating of steel and asked if they were interested and why. We found that we were promoting a potential solution to one of their severest headaches—uncertain heating results. So we pursued our investigation to learn what size pieces of steel should be heated in a demonstration to create the greatest interest.

We also asked what size ingot would be sufficiently large to be impressive. We finally settled on three coil sizes. An 8x8x32-in. size approximated the work of tool steel mills and forging shops. A 13x13x32-in. size was large enough to impress the steel mills which roll large ingots that size is no limitation to this kind of heating. These larger mills also showed a keen interest in slab heating. Consequently, a 6x18x31-in. size was included to prove that this shape could be heated by induction, too.

2. We invited our customers to join us in our experiments. We told them we were sure that 60-cycle induction coils would heat steel fast and asked them to help us explore the possibilities. We requested that they supply steel billets, bars, and slabs of specified sizes to fit the three coils.

We asked for various kinds of steel —low carbon, silicon, magnetic stainless, non-magnetic stainless, and tool. It was necessary that each piece be drilled in three to five places for thermocouples, and that a lifting lug be fastened to each piece. One company spent $1,500 in labor preparing 14 pieces. Others spent lesser sums. Finally we had 10 tons of steel billets.

3. We planned a campaign to get out the right people. As soon as the demonstration date was set, we began calling on executive personnel of our customers to insure attendance of policy making people as well as of metallurgists, research and operating men. A day was set aside and labeled as a special day for each of our four largest customers. This was quite effective. These companies then felt keenly responsible for the attendance of key people on their day.

On U. S. Steel Day, for instance, the operating vice-president's office scheduled the attendance of 46 from its headquarters office and from plants as far away as Chicago. Personal letters of invitation were sent. We checked to find out who in each company was scheduled to come and, in some cases, made suggestions.

(*Continued on next page*)

Sell 'Em in Bunches

(*Continued from previous page*)

4. We secured wide publicity. Our publicity department held a press conference prior to the demonstrations. Invitations were sent to various steel and electrical trade magazines as well as newspapers and wire services. Eight accepted.

We transported the group from Pittsburgh to Uniontown and demonstrated both 60-cycle and dual-frequency heating. At the luncheon that day the implications of the demonstrations were discussed. A press package for each reporter included pictures of the demonstrations and information about induction heating and the clinic.

Resulting publicity was surprising. Good coverage appeared in Business Week, Iron and Steel Engineer, Steel, Electrified Industry, Electrical World, Wall Street Journal, and Bituminous Coal Research Quarterly. An Associated Press release was carried in many newspapers over the country.

Apparently good industrial stories are in demand. More requests for press packages followed, and other publications carried the story later. We received letters from France, England, and Germany—the latter two enclosing trade papers from those countries containing write-ups about the clinic. Interest remained keen because during the next two months more than 50 requests for information were received from all over the U. S. and Canada.

5. We enlisted the aid and cooperation of our neighboring utility friends. We can often be more effective by collaborating in our promotions with other utilities.

We knew that interest in our subject was not confined to our territory and that acceptance of 60-cycle heating would develop on a national scale, not on a West Penn scale.

So, to make this promotion most effective, we invited our neighboring electric utilities and their customers. About 450 persons attended, excluding West Penn employees. In addition to our local customers, people came from Texas, Wisconsin, Ontario, New England, and scattered points in between. All told, people representing 65% of the nation's steel-making capacity attended as well as many fabricators.

6. We presented dramatic demonstrations. The meetings were scheduled to begin at 10 A.M. As people came in, they signed a register. An urn of coffee was ready, and until the meeting was called to order, our visitors inspected the coils and sipped coffee. Ingots had previously been placed in the coils with thermocouples attached. In front of each coil was a large card with a sketch of the ingot inside, showing dimensions, kind of steel, weight, and position of the thermocouples.

The audience sat facing the recording instruments and coils. High on the wall behind the instruments were two screens upon which two viewgraphs could project curves. A West Penn man was master of ceremonies.

He emphasized that these coils were not production tools but were experimental units designed to point the way to further development of this method of heating. He explained what would be demonstrated, what data would be taken, how the equipment was connected, and what the group would see. He announced that copies of data about to be recorded would be mailed the following day to those requesting it on our prepared card. Almost everyone asked for this data.

He then introduced a General Engineering Co man who immediately jabbed a pushbutton. The breaker slammed closed and energized the 8 x 8-in. coil. For the next 10 min, 60-cycle induction heating was discussed, including how the heating occurs, the range of its applications, and the relative cost of equipment.

Meanwhile, meter readers took data every 2 min and, on one viewgraph, plotted temperature at the surface and at the center of the steel. On the other machine they plotted kw input and amperes. In 10 min the temperature had climbed to 1,600F.

The audience then was invited to peer in the coil and see the ingot at a red heat. After 18 min the ingot had reached a temperature of 2,180F at its surface, and 2,020F at its center. The power was switched off. Two minutes later the temperature had equalized at about 2,150F, and the piece was lifted out of the coil.

To heat a 615-lb ingot to this temperature in 20 min was startling. Even the most skeptical were deeply impressed. The smallest ingot was heated first to demonstrate speed of heating. Next the largest ingot, weighing 1,500 lb, was heated in a few minutes less than an hour.

During the heating, the master of ceremonies carried on a running commentary over a PA system about the progress of the heating, the power factor, power-factor correction, power supply, etc, and answered questions.

To save time, we kept the crowd together by eliminating the need to take customers to a restaurant for lunch. We served coffee and let the men make their own sandwiches at one end of the building.

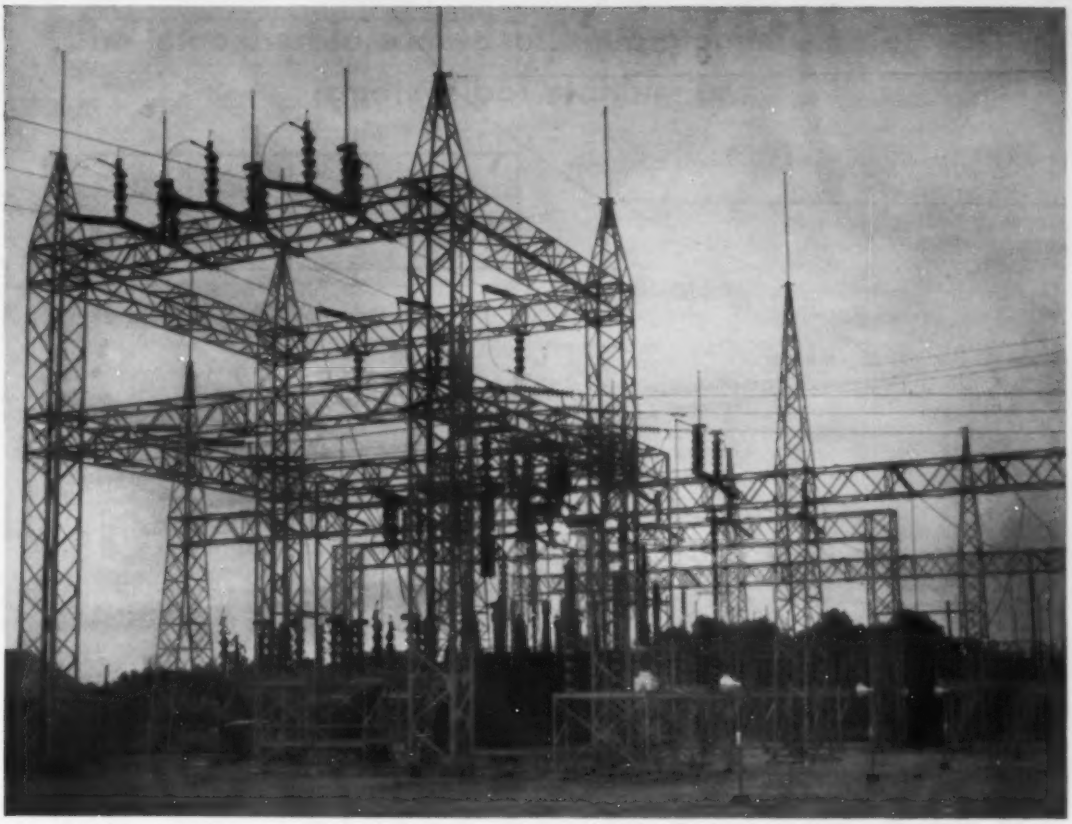
After lunch a continuous bar heater was operated. Bars of 2 x 2 x 18 in. were fed in at one end. They passed through a 60-cycle coil, which heated the piece to about 1,400F, and then through a 1,000-cycle coil, which raised the temperature to about 2,000F. A 50-kw rotating frequency changer generated the 1,000-cycle power. A bar emerged from the furnace every 90 seconds.

During these demonstrations, many questions were asked of both the General Engineering people and West Penn representatives. At the end, a formal question-and-answer period stimulated many more.

After these demonstrations we received many requests for special tests. We undertook all of them, even those from non-customers. We heated brass, aluminum, glass molds, coiled strip, graphite crucibles, and steel pipe, and we melted glass.

The heating clinic dramatized how low frequency heating of steel ingots is faster than any other method known to the steel industry. The benefits are so obvious to steel men that they are eager to solve remaining problems; namely: What are the metallurgical limitations and benefits? How are steel ingots to be moved through coils? What are the economics?

7. We are following up with our customers by personal contacts. Several are studying specific applications, and the outlook is promising. We know that there is an awakened interest in this tremendous market among equipment manufacturers, and we know that among steel producers throughout the country there is a growing acceptance of the idea that 60-cycle heating will produce a better product. From our vantage, it was a highly successful group promotion.



NEW GROUNDING DESIGN IS EXEMPLIFIED BY USE OF 77 RODS IN 200x200-FT AREA AT 138/230-KV SUBSTATION

For an Effective, Low Cost System . . .

Let's Look to Station Grounding

SIX GUIDES TO BETTER GROUNDING

- Cross connections in grids do not materially lower the resistance, but other considerations may warrant their use
- Simple loops are the most economical
- Rod arrangements are preferable, but the aiding influence of connecting wires should be disregarded
- Arrangement of rods or grids in regular or irregular patterns is immaterial
- Driving too many rods in limited areas is just as uneconomical as crisscrossing wires
- Rods should be spread over wider areas or distributed over several patches with individual rodbeds interconnected

STEPHEN J. SCHWARZ, Senior Electrical Engineer, Sverdrup & Parcel, San Francisco, Calif.

Application of a new concept for computing ground resistances of grid and rod arrangements shows that many generally accepted practices today can be simplified resulting in greatly reduced costs. Considerable confusion prevails in the present-day design of grounding systems for power plants and substations. Many misconceptions are attributable to lack of a simple mathematical analysis. It is not unusual to encounter ground grids with meshes as close as 10 x 10 ft or combinations of rodbeds with elaborate grids.

Four Methods of Grounding . . . Low resistance to ground is essential to prevent an excessive potential rise

How to determine ground resistance of horizontal grid and multiple rod systems:

Ground resistance of a loop or grid is:

$$(1) \qquad R = \frac{1.045\,\rho}{L}\left(\log_e \frac{2L}{a} + k_1\frac{L}{\sqrt{A}} - k_2\right)$$

and for several rods in parallel:

$$(2) \qquad R = \frac{0.52\,\rho}{nL_r}\left[\log_e \frac{4L_r}{b} - 1 + \frac{2k_1L_r}{\sqrt{A}}\left(\sqrt{n}-1\right)^2\right]$$

where:

ρ = Soil resistivity (ohm-meters)

L = Total length of all interconnected horizontal wires (ft)

L_r = Rod or pipe length (ft)

$a = \sqrt{\frac{1}{12}\text{ conductor dia (in.)} \times \text{depth (ft)}}$

$b = \frac{1}{24}$ Rod or pipe dia (in.)

n = Number of parallel rods or pipes

A = Area (sq ft) enclosed by the loop, the farthest outside wires of a grid, or a line connecting the rods or pipes at the farthest outside position.

k_1, k_2—Coefficients from Fig. 1

These examples illustrate use of the formulas:

Example 1—A grid shall consist of 4/0 wires buried at 30 in. below grade. The total length of wires and area covered are:

$$L = 2 \times 120 + 3 \times 30 = 330 \text{ ft}$$

$$A = 120 \times 30 = 3{,}600 \text{ sq ft, and } \sqrt{A} = 60 \text{ ft}$$

The diameter of a bare stranded 4/0 cable is 0.528 in., so that

$$a = \sqrt{\frac{0.528}{12} \times 2.6} = 0.337 \text{ ft}$$

The coefficients taken from Fig 1, curve A (as close to earth surface), for a 1:4 rectangular area shape are $k_1 = 1.24$ and $k_2 = 6.09$. With these values entered in formula (1) and assuming a soil resistivity of 50 ohm-meters:

$$R = \frac{1.045 \times 50}{330}\left(\log_e \frac{660}{0.337} + 1.24\,\frac{330}{60} - 6.09\right) = 1.32 \text{ ohm}$$

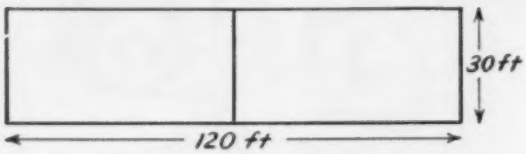


FIG 2—EFFECTIVENESS AND ECONOMY combine in narrow-strip ground mat

Example 2—If 30 rods of 10-ft length and ¾-in. dia are driven in any arrangement inside the 120 × 30-ft area, formula (2) furnishes:

$$R = \frac{0.52 \times 50}{30 \times 10}\left[\log_e \frac{40}{0.0313} - 1 + \frac{2 \times 1.24 \times 10}{60}\left(\sqrt{30}-1\right)^2\right] = 1.25 \text{ ohm}$$

For the combined resistance of grid and rodbed, the ground resistance of the grid alone (R_{11}) and of the rodbed alone (R_{22}) must first be computed from equations (1) and (2), as shown in the foregoing, and also from the mutual resistance:

$$(3) \qquad R_{12} = R_{11} - \frac{1.045\,\rho}{L}\left(\log_e \frac{L_r}{a} - 1\right)$$

The combined ground resistance R then is:

$$R = \frac{R_{11}R_{22} - R_{12}^2}{R_{11} + R_{12} - 2R_{12}}$$

Example 3—If the combined ground resistance of a grid and a rodbed, as computed in Examples 1 and 2, is sought, $R_{11} = 1.32$, $R_{22} = 1.25$, and:

$$R_{12} = 1.32 - \frac{1.045 \times 50}{330}\left(\log_e \frac{10}{0.337} - 1\right) = 0.94 \text{ ohm}$$

The combined ground resistance:

$$R = \frac{1.32 \times 1.25 - 0.94^2}{1.32 + 1.25 - 2 \times 0.94} = 1.11 \text{ ohm}$$

shows only a small reduction in resistance below the values for the individual components.

Mathematical Analysis Guides Cost Comparison of Ground

during faults. To establish a low-resistive station ground, consider any of these methods:

1. Using the grounding network. This network is necessary under the switchyard or outdoor substation to equalize the earth surface potential and to ground scattered equipment.

2. Adding driven rods or pipes to the grounding network or extending the mat over a wider area.

3. Installing another loop or mesh in the subsoil if the equalizing grid is installed in high resistive soil (fill) or if the top-soil resistivity is not dependable, ie, rising to high during dry seasons.

4. Installing one or more groundbeds of wire mesh or rods at locations of low soil resistivity remote from the station area.

In providing the low-resistive ground, the designer has to make a sound economical selection as to type, layout, and dimensions of the grounding system. With soil resistivity known from tests or intelligent guesses, the problem becomes a cost comparison of geometrical configurations. Values for different types of soils and in certain localities are given in Circular C450 of the National Bureau of Standards, "Underground Corrosion," Gov-

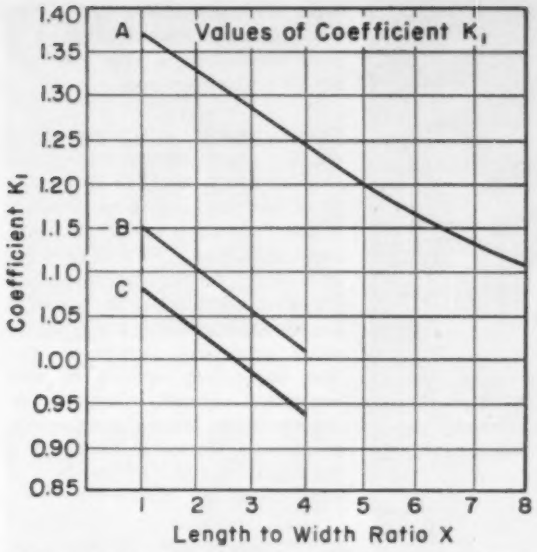
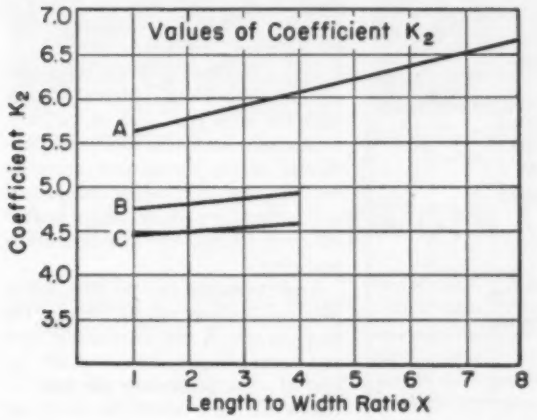


FIG 1—FORMULA COEFFICIENTS can be selected from Curve A for negligible depth, from Curve B for depth 1/10 and Curve C for depth 1/6 of square root of area



Grid Configurations

ernment Printing Office, Washington 25 D. C.

Comparatively simple mathematical expressions for determining ground resistance of horizontal loops or grids and multiple rod arrangements were developed recently by the author in "Analytical Expressions for the Resistance of Grounding Systems," AIEE Technical Paper 54-201. These expressions enable the designed to evaluate all influencing factors rapidly and with fair accuracy. The previous hit-or-miss method frequently led to overdesign.

Computing Ground Resistance . . . The expression for ground resistance of a loop or grid is given in equation 1, that for several rods in parallel in equation 2. These furnish results within a few percent of actual test data and are particularly useful where rods or meshes are unevenly distributed over an area, a common feature of practical design. The formulas indicate that wire, rod, or pipe diameter is of only minor signficance.

With dimensions generally encountered, metallic resistance, and thus the material used, does not affect results. Selection of material and cross-sectional dimensions is governed only by mechanical strength, corrosion, and current-carrying capacity. Use of the formulas is illustrated in the examples.

Different Schemes . . . Figs 3 and 4 graph the relative effectiveness of several configurations. The diagrams are based on 4/0 stranded cable and 10-ft rods of ¾-in. dia in square and rectangular (1:4 ratio) areas of 10,000 and 40,000 sq ft as typical examples. Most practical cases fall within or near that range. Resistances computed from the formulas are plotted for a soil resistivity of 100 ohm-meters (10,000 ohm-cm) and are proportionately higher or lower for other values.

Curves in Fig 3 start with a simple loop around the area and show the influence of additional wires inside the area on resistance. The curves attenuate towards the resistance of a metallic plate replacing the grid for an infinite amount of wire.

Fig 3 shows that substantial savings can be realized by spreading loops or grids over wider areas. Conversely, it is shown that very little is gained by increasing the number of meshes. For example, doubling the amount of buried wire within an area (with doubling of the costs) generally lowers the resistance less than 10%.

Substantial advantage can be gained by arranging a grid of given area in a narrow strip. For example, the resistance of 800 ft of wire inside a 100 x 100-ft square is 12% greater than the same wire length in a 50 x 200-ft rectangle and 50% greater than in a 35 x 284-ft area.

Loop Most Economical . . . A simple loop, encircling the largest area available, is the most economical design although other considerations may dictate a grid. A single straight wire or length equal to the loop would be slightly lower in resistance but usually is not advisable because a wire break could destroy its effectiveness as a ground.

Of course, consideration should be given to conditions of the site and

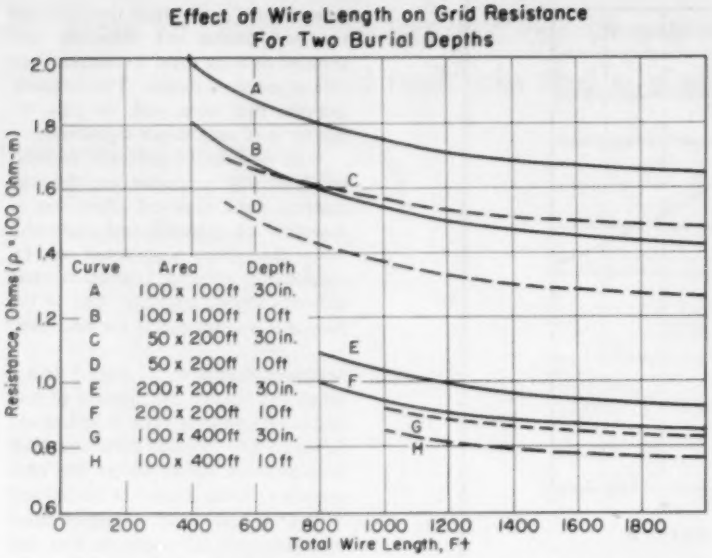

Effect of Wire Length on Grid Resistance
For Two Burial Depths
Resistance, Ohms (ρ = 100 Ohm-m)
Total Wire Length, Ft
Curve Area Depth
A 100 x 100ft 30in.
B 100 x 100ft 10ft
C 50 x 200ft 30in.
D 50 x 200ft 10ft
E 200 x 200ft 30in.
F 200 x 200ft 10ft
G 100 x 400ft 30in.
H 100 x 400ft 10ft

FIG 3—GRIDS of several configurations show effect of more wire in area. Note burial depth effect on decreasing resistance

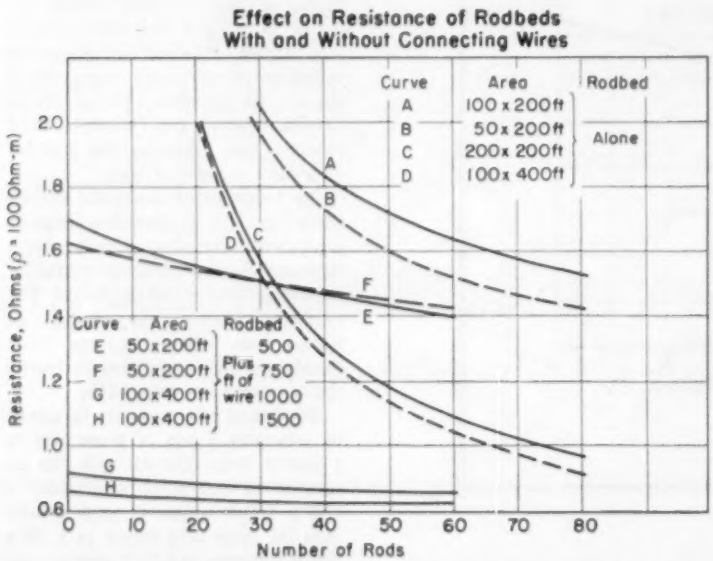

Effect on Resistance of Rodbeds
With and Without Connecting Wires
Resistance, Ohms (ρ = 100 Ohm-m)
Number of Rods
Curve Area Rodbed
A 100 x 200ft
B 50 x 200ft
C 200 x 200ft
D 100 x 400ft
Alone
Curve Area Rodbed
E 50 x 200ft 500
F 50 x 200ft 750
G 100 x 400ft 1000
H 100 x 400ft 1500
Plus ft of wire

FIG 4—GROUNDING RODBEDS alone and interconnected show effect on resistance. Curves tend to approach the resistance of a buried plate of the same size as area

its varying resistivity, the need for cross connections to ground equipment, and other safety measures. A single break will not affect ground resistance, but when cut in two places the loop loses part of its effectiveness. Consequently, one or two cross connections may be advisable.

Curves A-D in Fig 4 show resistances for multiple rod arrangements with no help from the interconnecting wires. Little is gained by increasing the number of rods beyond a certain value because the curves tend toward the resistance of a plate equal in size to the area. Again the real gain is achieved by spreading the rods over wider areas. Resistances of a varying number of rods connected through certain wire arrangements at 30-in. depth are represented in curves E-H. The decrease in resistance because of cross connections is even less than for the grid without rods.

Costs Compared . . . One ground rod installed and connected costs about as much as 20 ft of wire buried to 30 in. At this ratio compare curves E and F in Fig 4 with C in Fig 3, and G and H in Fig 4 with G in Fig 3. To reach the same resistance, adding rods to a grid costs about the same as adding criss-crossing wires. Yet either supplement contributes little. The simple loop appears as most economical, especially when equal resistivity can be assumed for the comparison and the soil at the depth of the buried loop is, permanently in a moist condition.

More often than not, resistivity at grid location is higher. If there is any doubt, rods should be used if feasible, their number being sufficient to produce the desired resistance. The aiding influence of the connecting grid is an added safety factor, but it should be neglected for this reason.

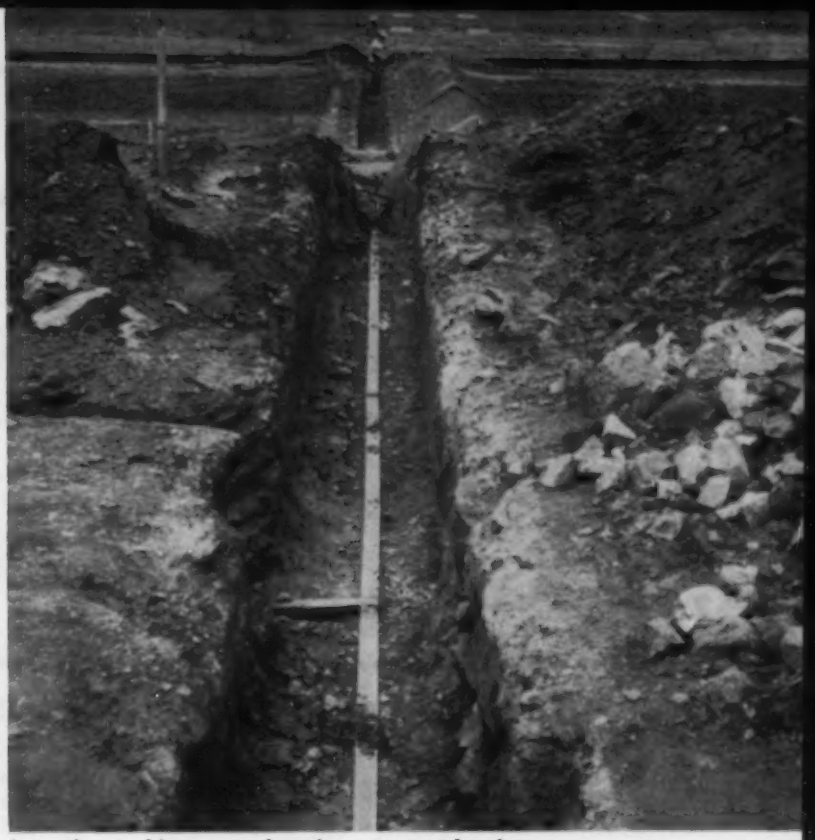
Fig 4 discloses that for equal resistivity in a 50 x 200-ft area, 42 rods have the same resistance as the loop, connections not being considered. Influence of the connections depresses the resistance 13%. When connections are buried in soil of higher rather than equal resistivity, this decrease is negligible.

Low resistance may be obtained in high-resistive top soil by burying the loop deeper. A cost comparison with rod arrangements must include the cost of wires connecting the rods. A reasonable cost would be 10 ft of wire buried to 10 ft as equivalent to one rod installed, including connecting wire. Comparing Figs 3 and 4 at that ratio shows that, generally, rods cost less than the deep grid for equal resistance and are preferable.

Rods May Be Better . . . Uncertainty in establishing reliable values for soil resistivity should be given due consideration. It often is not realized that instruments in common usage measure the resistivity averaged over a certain depth. Test results thus will be correct for rods, but may be questionable for the layer in which the grid is buried. Even if point-to-point and seasonal variations are accounted for, it may be advisable to install rods rather than grids, despite the fact that grids appear more economical.

Lap welds and . . .

Reinforcements . . .



Join buried bars and tubes in grid where . . .

All-Steel Network Grounds Substation

GLEN APPLEMAN, Retired,* and
S. J. LITRIDES, Project Engineer, Pennsylvania Power & Light Co, Allentown, Pa.

Steel is used exclusively for the grounding network at Hosensack and 16 other substations of the Pennsylvania Power & Light Co system. Its advantages are:

1. Elimination of galvanic action between dissimilar metals in the earth.

2. Ability to provide cathodic protection to the grounding system and all other metal objects connected to it in the area.

3. Ability to obtain material for grounding when copper is scarce during critical times.

For many years engineers have been aware that use of dissimilar metals in grounding systems for generating stations, substations, or large industrial plant power systems is permitting much more corrosion than should be accepted as good practice. The usual driven steel pipes or rods connected into a network by bare copper conductors buried in the ground form a huge galvanic cell. In time galvanic action corrodes the zinc galvanizing from the driven rods or pipes and then the steel. In the course of a few years not much is left but the copper conductors.

Several years ago PP&L abandoned use of driven rods or pipes, except for small grounding networks. The change had little effect on station ground resistances, indicating that the buried conductors themselves and the facilities they tie together provide adequate grounding.

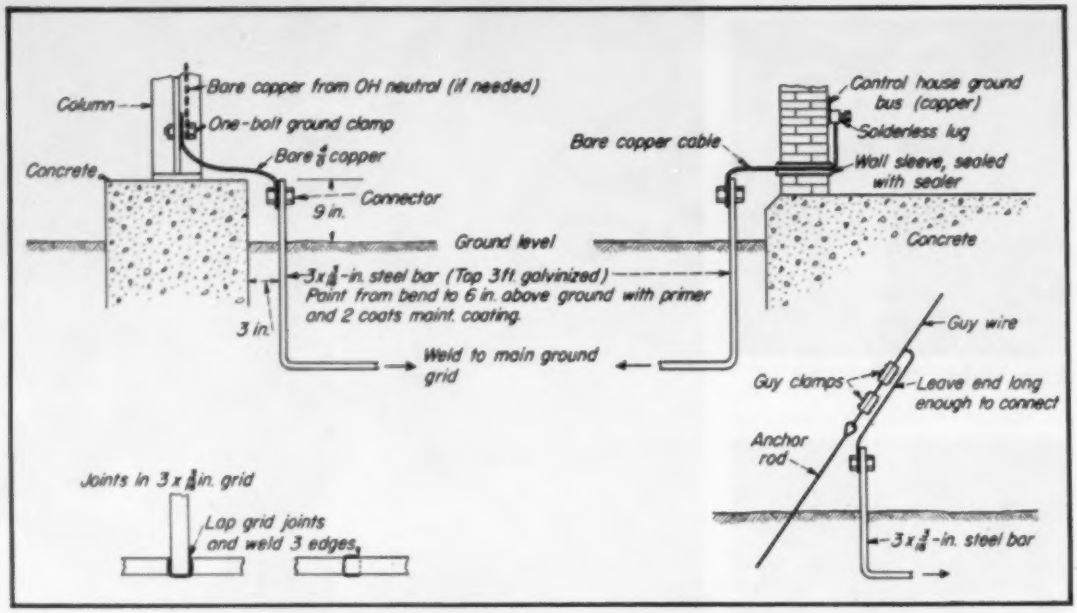
Damage may extend to all other steel or galvanized members, such as conduits; structure footings; metallic sheathed cables; pipes used for water, steam, gas, oil; and to any other conducting objects in contact with the earth where such facilities are grounded to the network deliberately or accidentally. This same harmful combination of dissimilar metals is encountered in transmission lines where steel tower footings are grounded by means of a copper or copper-clad counterpoise, crow feet, or other copper grounding network.

Distribution systems generally use copper-clad driven ground rods for the secondary or common neutral. This neutral may be grounded to other driven rods or pipes of steel, such as anchor rods. Neutrals are also grounded at consumers' service connections to water and/or gas supply pipes, most of which are plain or galvanized steel but in some cases are brass, copper, or lead. Serious galvanic corrosion may be experienced in these cases.

Corrosion by Copper . . . Steel, iron, zinc, and lead are all anodic to copper in the earth. When an electrical circuit exists where copper is in combination with one or more of these other metals, there will be current from them into the earth and thence

(*Continued on next page*)

*Formerly Control Equipment Engineer



Details of All-Steel Grounding System

to the copper. Copper is not damaged by this action, but usually all the other metals are. Extent of damage depends upon resistance of the circuit and the voltage generated by these various combinations. Copper generates about 0.50 v to lead, 0.80 v to iron and steel, and 1.10 v to zinc, under the usual assumed conditions. For every ampere year lead loses about 73 lb, zinc about 24 lb, and iron or steel about 20 lb.

The most obvious solution to this damaging condition is to use only one of these metals in the underground facility. Direct contact with ground must be eliminated for any facilities that must be made of other metals. Because most of the facilities in the ground are made of iron or steel, it would appear that a grounding network made up entirely of steel rods, bars, or pipes all bonded together by steel conductors would be satisfactory.

Any attempt to provide an externally operated cathodic drain in any combination of dissimilar metals requires more drainage for protection of the steel than is required for steel alone. A combination of copper and steel, for instance, requires at least 15 times as much cathodic drain current to protect the steel facilities in the yard as would be required to protect an all steel ground network. This means consuming the anode into which the cathodic drain current is dumped 15 times as fast and requires 225 times the power to drive it. If any attempt is to be made to protect steel in the ground, there is practically no choice except to use all steel and to exclude contacts with earth of all other metals.

Conduits and Structures Contribute . . . All steel conduits—and station structural members—become part of this network and make a helpful contribution to the all steel grounding system. Lead sheathed cables, when required, may be covered with heavy grease and placed in steel conduits so as to have no direct contact with the ground. Other facilities of a special nature such as copper or brass pressure or capillary tubes, etc, may be run through steel pipe wherever they go underground. Galvanized steel when placed in the ground may lose its galvanizing because of sacrificial action of the zinc, but in general, the use of all steel in the ground precludes the possibility of galvanic corrosion.

Three primary considerations guide the design of a grounding network:

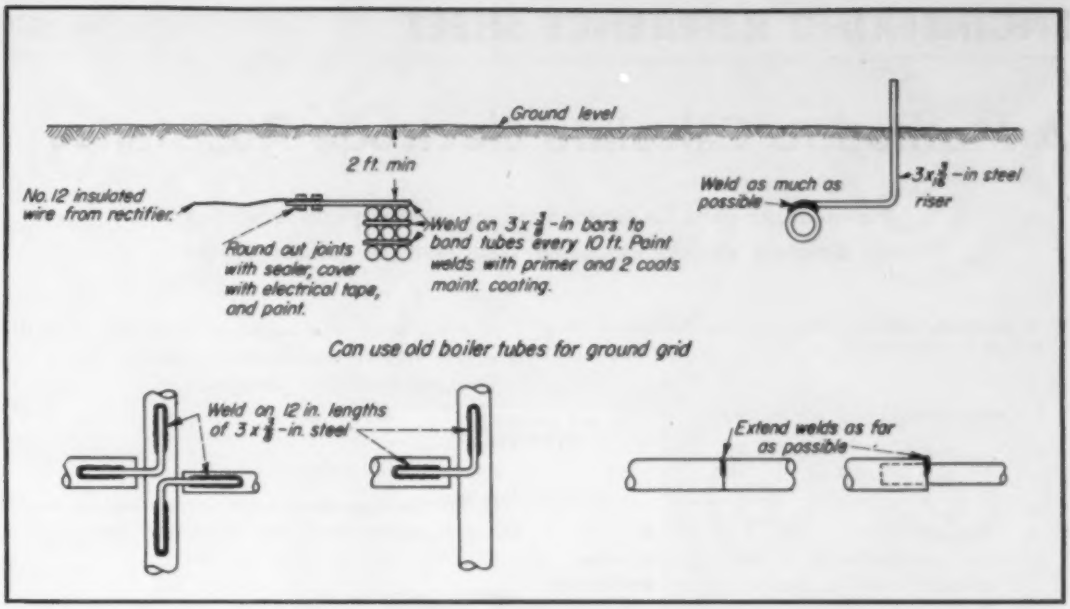
1. It must accept the maximum ground fault current likely to be experienced at any point in the grid without danger of burn-off.

2. Voltage drop from any point on the grid to any other point on the grid must be low enough to prevent hazard to circuits in the area covered by the ground system.

3. It must produce a satisfactorily low resistance contact to "earth."

Fault Currents Set Steel Size . . . Steel bar is routed much the same as a copper cable network. But the resistance of the two metals is quite different. For a given resistance per unit length it would require about eight times as much steel as copper. This steel conductor would produce the same amount of heat during a fault as its copper equivalent would produce.

Ability to absorb this heat and keep within safe temperature limits is influenced by three principal factors—relative weight per unit cross section, specific heat, and melting temperatures. Steel weighs only 0.88 as much as copper per unit volume but absorbs more heat per pound per degree rise in temperature because its specific heat is 1.16 times that for copper. It can thus absorb 1.02 times the heat of an equal volume of copper for the same temperature rise. But steel has a melting temperature of 1,810K compared with 1,356K for copper. Hence steel can absorb approximately $1.02 \times \frac{1810}{1356} = 1.36$ times the heat of an equal volume of copper before fusing.


Ground level
2 ft. min
No. 12 insulated wire from rectifier.
Round out joints with sealer, cover with electrical tape, and paint.
Weld on 3 x ⅜-in bars to bond tubes every 10 ft. Paint welds with primer and 2 coats maint. coating.
Weld as much as possible
3x⅜-in steel riser
Can use old boiler tubes for ground grid
Weld on 12 in. lengths of 3 x ⅜-in. steel
Extend welds as far as possible

Scrap Steel Used as Anodes for Cathodic Protection

From this it would appear that a steel conductor having the equivalent of 8/1.36 = 5.875 times the cross-section of a copper conductor should have about the same burn-off characteristics.

To take a particular case, 2/0 copper would be considered the smallest conductor size from mechanical strength consideration. It has a burn-off value of 13,500 amp in two seconds and could be used safely where fault currents to ground do not exceed 13,500 amp. Circuit breakers operating in less than ten cycles would provide a safety factor of 12, with plenty of time for back-up relaying in case the first line relays fail.

An equivalent steel conductor requires 5.875 x 133,100 cm or 781,963 cm. This is equal to 0.614 sq in. cross section of steel. A standard 3 x 3/16 in. flat bar with a cross section of 0.562 sq in. provides a safety factor of 11 against burn-off for fault currents of 13,500 amp.

Voltage Drop Meets Requirements . . . Drop in voltage across the area covered by the grounding system is the second condition to examine. Assume the station plot is 500 x 1,000 ft with four runs of buried conductor each way equally spaced and connected together at every intersection point. Effective distance from the two most remote corners would be roughly 375 ft single conductor equivalent. It is assumed that the average distance current would flow is half this value which provides a good safety factor. Thus the effective distance for voltage drop consideration is around 187 ft.

Resistance of 2/0 copper is 0.08 ohms per 1000 ft. For 13,500 amp flowing in 187 ft, the voltage drop would be about 200 v. To obtain a 100-v drop, conductors would have to be equivalent to two 2/0 copper wires or one steel bar 3 x ⅜ in. Where fault currents are less, the steel bars may be smaller.

Satisfactory contact to earth is the third requirement. Preliminary tests of this station plot (actually Hosensack Sub-station) showed that the ground resistivity varied greatly over the area but 10,000 to 20,000 ohms seemed reasonable. This should give resistance to earth of 0.07 to 0.14 ohms with about 1,000 to 2,000-v rise at 13,500 amp. Tests on an installation of about these dimensions showed 0.18 ohms.

Scrap Steel Cuts Cost . . . Assume 2/0 copper costs about $500 per ton and steel about $150 per ton in flat bars 3/16 to ⅜ in. thick and 3 in. wide. The above example would require about 2½ tons of copper costing $1,250 or about 11½ tons of steel costing about $1,725. Labor costs would be approximately equal for the two types of ground system. In other words, a steel grounding system will be more economical whenever copper prices per pound exceed that of steel by 5 or 6 times, neglecting the cost of cathodic protection.

Several more recent ground networks use scrap boiler tubes for the grid itself. This cuts the cost of steel to its current scrap value of about $20 per ton and enables the steel grounding system to be built for considerably less than the copper equivalent.

Completed Grids Provide Test Data . . . Seven such grounding systems have been tested on the Pennsylvania Power & Light Co system. Resistances to earth have measured 3.0, 4.9, 0.62, 3.0, 10.4, 3.0, 2.0 ohms. Currents required in the cathodic drains to clear the stations to 0.850 v through a copper sulphate half cell tested 3.00, 1.18, 10.00, 3.0, 1.39, 0.30 and 1.00 amp respectively. Low ampere requirements for three of these cases are being provided with 17-lb magnesium anodes. The other four have rectifiers and steel anode beds made up of scrap steel, mostly abandoned boiler tubes. It is considered best economy to bury enough steel to last 40 to 50 years because steel used would otherwise be sold as scrap at about 1¢ per lb.

A Method to Calculate Electrode Resistance

Formulas are given for determining soil resistivity and resistance of different shaped grounding electrodes at various depths

W. F. DUNKLE, Supervisor of Electrical Tests, Pennsylvania Power & Light Co, Hazelton, Pa.

I. Determination of ρ, soil resistivity

$$\rho' = 2\pi AR \quad (1)$$

$$\rho = 2\pi(12 \times 2.54A)R \quad (2)$$

where:

A = distance between electrodes; use 10 ft
R = resistance indication by ground tester; ohms
ρ' = average resistivity (per cu ft) of soil for depth of 10 ft
ρ = average resistivity (per cc) of soil for depth of 10 ft

II. Calculation of R, resistance to ground of buried electrodes—(A) hemispheres, (B) pipes or rods and (C) other shapes.

General formula for ground resistance is:

$$R = \rho/2\pi C \quad (3)$$

where:

R = resistance from electrode to ground; ohms
ρ = soil resistivity per cc; ohms
C = electrostatic capacity of electrode and its image; C.G.S. units

A. For a hemisphere buried in the earth with its flat side flush with the earth's surface, capacity $C = r$.

Then resistance of the connection is:

$$R = \rho/2\pi r \quad (4)$$

where:

r = radius of hemisphere; cm.

B. For the capacity of a rod or pipe (and its image) driven to a given depth into the earth, capacity

$$C = L/2 \log_e (2L/d) \quad (5)$$

where:

L = twice the depth to which the pipe is driven; cm
d = diameter of pipe; cm

With L and d in cm and ρ in ohms per cc, then:

$$R = \rho[\log_e (2L/d)]/\pi L \quad (6)$$

With L in ft and d in in., ρ in ohms per cc, then:

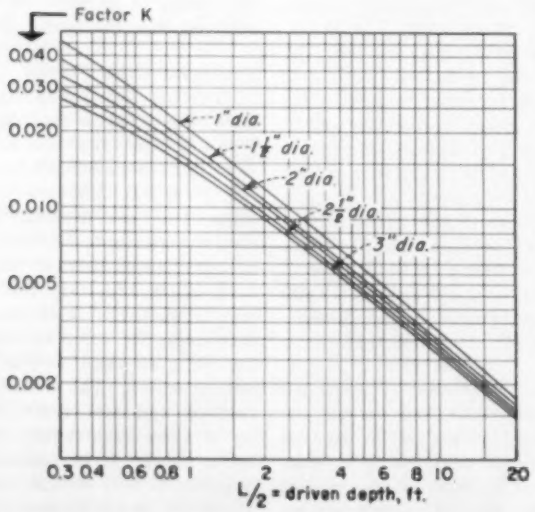
$$R = \rho K \quad (7)$$

where:

$K = \log_e (24L/d)/95.71L$

C. For other shapes of buried electrodes, such as an angle or channel, a hemispherical radius equivalent to the buried electrode may be substituted.

References: U. S. Bureau of Standard Tech. Paper 108, O. S. Peters; James G. Biddle Co. Bulletin 1285; G. E. Review, 1915, E. E. Creighton



Factor K for several pipe or rod diameters (in.) and driven depths (L/2 ft); used with Equation 7 in the article above

This method of calculating electrode resistance was used to design the ground grid tests which are described in "Steel Ground Grid Works Well" on the opposite page.

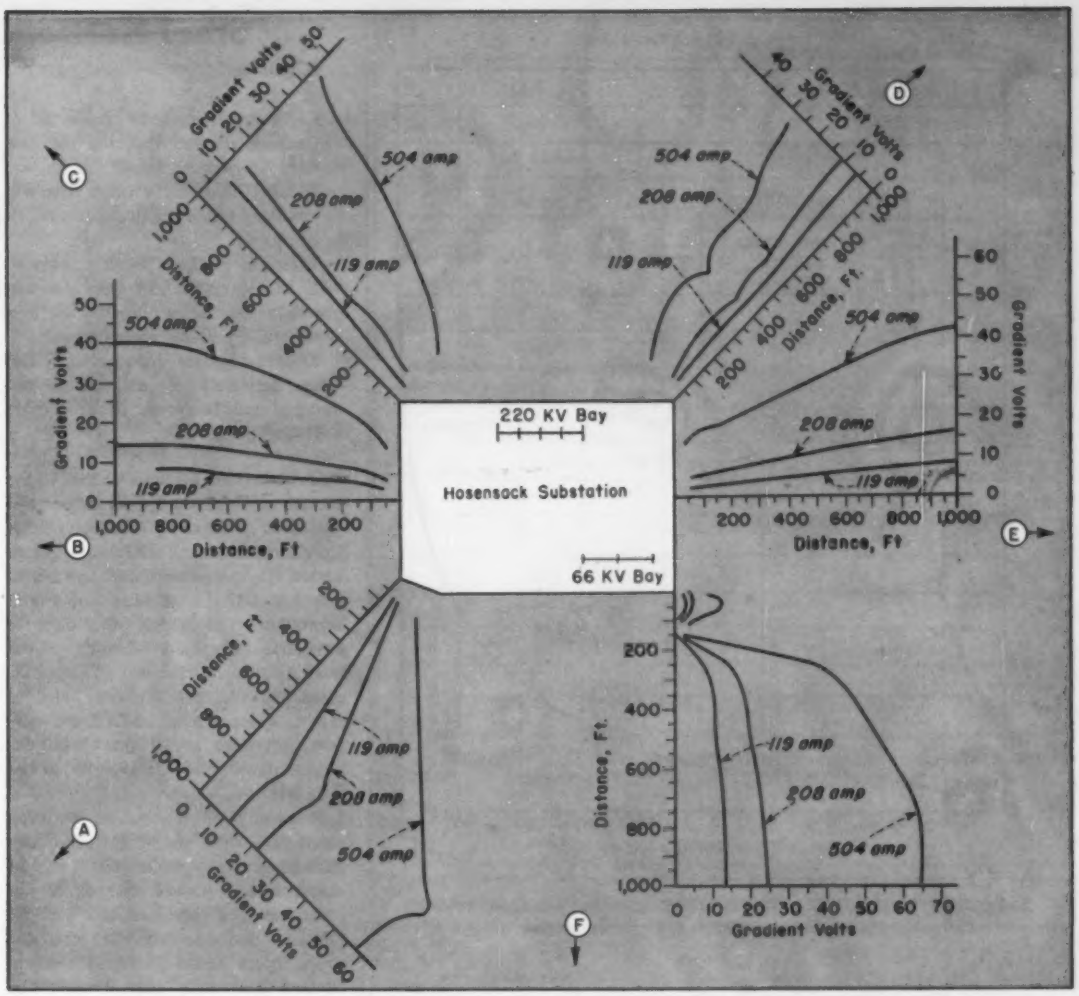


FIG 1—VOLTAGE READINGS SHOW GRADIENT TO 1,000 FT IN SIX DIRECTIONS FOR THREE TEST CURRENT VALUES

Hosensack Tests Prove . . .

Steel Ground Grid Works Well

Measurements show voltage rise on non-copper grounding network would remain well within limits of the installed 4-kv protective neutralizing facilities

W. F. DUNKLE, Supervisor of Electrical Tests, Pennsylvania Power & Light Co, Hazelton, Pa.

A ground grid composed of steel instead of copper bars has proved effective for the Hosensack Substation of Pennsylvania Power & Light Co. Tests have clearly established that voltage rise will remain well within limits of the installed 4-kv protective neutralizing facilities.

These tests also indicated that large city water systems, with good continuous conduction capability ground networks attached, experience little voltage rise on the occasion of a fault. Continuous watch must be kept over such systems, however, because of the possibility of substitution of transite in the replacement of worn or defective metal pipe.

Connections to ground are satisfactory when they dissipate large currents into the ground without raising the potential near the connection to dangerous values. Resistance of the soil around ground networks to current flow largely determines the effectiveness of the network as a protection against voltage gradients. The physical and electrical characteristics of the soil in the area of a substation require careful study. When resistivity of the soil is known, a satisfactory ground network can be designed. High resistivity requires a more extensive network.

(Continued on next page)

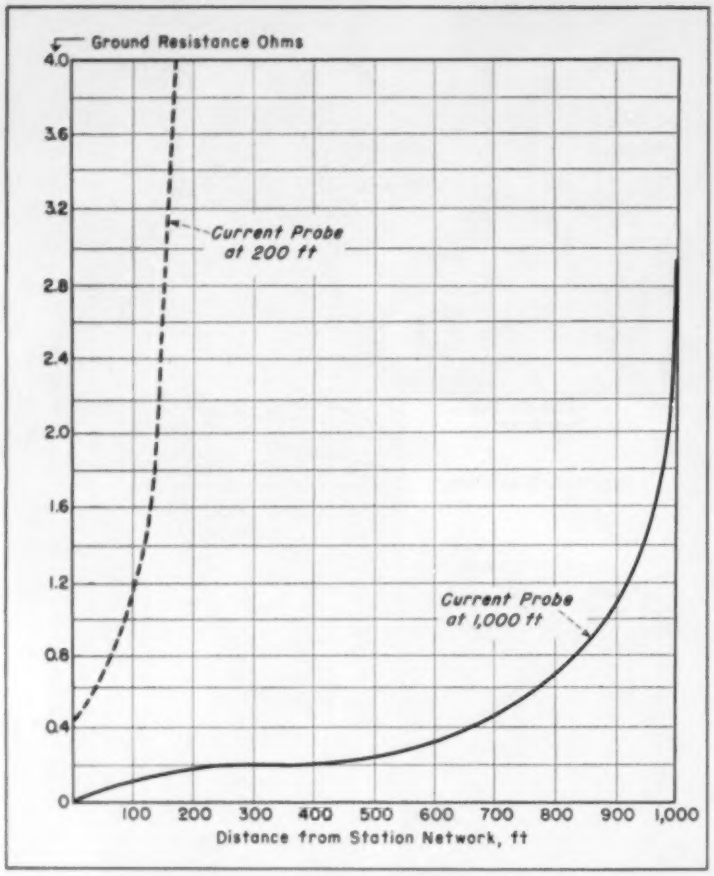


FIG 2—GROUND RESISTANCE MEASUREMENTS indicate improved accuracy of tests when current probe is driven 1,000 ft from large station ground network

Table I—Voltage Gradients Indicate Ohms Ground Resistance

Test	Amp	A	B	C	D	E	F
1.	118	.0977	.069	.0742	.0543	.0679	.1155
2.	208	.1055	.071	.0697	.0580	.0779	.1166
3.	504	.1146	.080	.0871	.0559	.0883	.1280

Table II—Reference to Ground Voltage at Remote Telephone Central Office Gives Total Resistance

Test	Amp	Voltage	Ohms
1.	119	27.5	0.230
2.	208	36.5	.175
3.	354	62.5	.176
4.	504	90.0	.1785

Steel Network

(*Continued from previous page*)

Earth resistivity tests conducted at Hosensack showed that the ultimate ground resistance would be in the order of 0.12 ohm, a value that will be obtained when the ground network is completed.

Two test methods were employed:

1. Measurement of the station ground resistance in ohms by use of a commercially made ground tester.

2. Measurement of voltage rise when relatively large currents are dumped into the ground network from a distant point.

Tester Checks Distance Effect . . . In the first method, resistance was measured at 10 and 50-ft intervals out from the Hosensack substation ground network to current reference probes at 1,000 ft. The solid curve of Fig 2 shows the type of resistance-distance data thus obtained. Results would have been closer to the values indicated by the Bell System pairs to remote reference grounds if the current reference probe had been extended another 500 ft away from the network.

Proximity of the station network interfered with the high resistance current reference probe at 200 ft, and measurements proved completely unsatisfactory. Experience and analysis indicate that the current reference probe must be at a distance equal to and preferably greater than the major diagonal dimension of the network.

Heavy Current Tests . . . The other method consisted of using power sources of 2,300 and 7,200 v to ground at Allentown substation with an isolated transmission line to Hosensack for dumping varying amounts of current into the Hosensack ground network, as shown in Fig 3.

The Allentown substation neutral network consisted of the Allentown and Bethlehem water piping, together with a large number of substation ground networks, all connected to the two water systems. This provided wide coverage for the return of fault current from Hosensack. As nearly as it can be measured, effective resistance of this network is 0.05 ohms.

Large Ground Networks Effective . . . During these tests, voltages were

measured every 10 ft for 100 ft, and then every 50 ft out to 1,000 ft between driven stakes and the Hosensack network. Current into the ground network was steady, and it was continuously observed for the duration of the tests over approximately 20 min. Fig 1 illustrates the voltage gradient out from the network, plotted against distance for different current values. The distance axis represents the direction of measurements away from the network.

During these tests relays connected by pilot wires at Freemansburg and converter substations showed off-scale on their indicating milliammeters. These locations are about 10 miles away from a direct line between Allentown and Hosensack. This is indicative of the gathering capability of large ground networks for return currents. At Hosensack all overhead ground wires and counterpoises were tied to the station ground network.

Resistance Values . . . Resistance values determined from the network's dissipation of the test currents are given in Table I. Bell Telephone Co pairs were used to observe voltage at the telephone offices at Pennsburg about 14 miles distant. Voltages between the ground network at Hosensack and Pennsburg are listed in Table II and plotted in Fig 4.

Tests indicated the effective resistance is:

1. By voltage measurement with current to a remote point, 0.176 ohm.

2. By ground tester at 1,000 ft distance, 0.20 ohm.

The rise of ground potential is then computed as current times effective resistance. Short-circuit capabilities of 10,000 amp to ground, according to the tests, would produce between 1,700 and 2,000-v network rise.

Other Conclusions . . . The tests showed also that network ground resistance values obtained by using a good quality, commercial ground tester are commensurate with results obtained by dumping large amounts of energy into the network. The cost ratio of measurement by a ground testing device to the energy method is 1 to 50 or less. Hence expensive tests, involving dumping large currents into networks, are not essential.

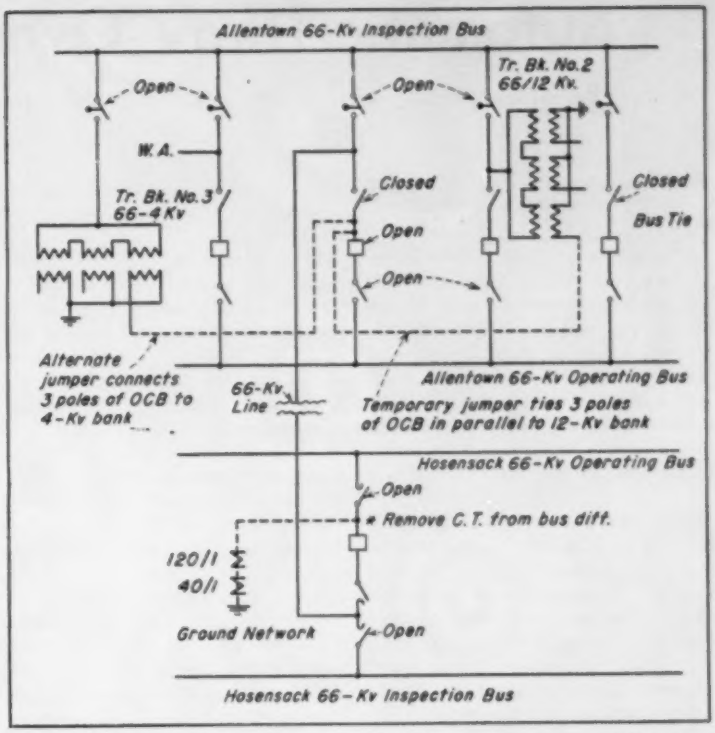


FIG 3—HEAVY-CURRENT TESTS required use of temporary jumpers at Allentown station to put Hosensack 66-kv line on 12-kv bank energized via bus tie OCB

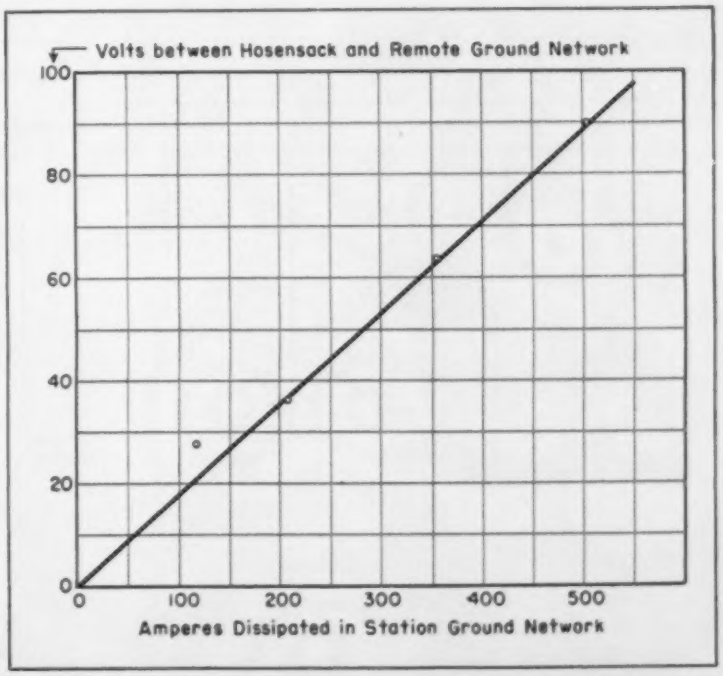


FIG 4—GROUND POTENTIAL rises above remote ground reference in direct proportion to value of current dissipated into the station ground network

Automatic Throw-Over Aids Radial

Florida P&L finds primary switch-over costs less than secondary network and continues

WILLIAM A. THUE, Assistant Underground Engineer, Florida Power & Light Co, Miami, Fla.

The fabulous "Gold Coast" hotels along Collins Avenue and the swank Lincoln Road shopping area on Miami Beach, Fla., are served today by the Florida Power & Light Co through primary automatic switch-over. Nine 13.8-kv feeders from two substations serve a connected load of 32,500 kva through 47 automatically operated submersible oil switches.

Studies Prove Merits of Plan . . . This method of improving service from a radial system was preferred by the utility to a secondary network on the basis of lower costs. Since installation in February 1950, the company has proved the merits of the plan through experience and economic studies. In fact, the system has proved so successful that the company is continually expanding it on Miami Beach. Other spot loads on the overhead and underground systems throughout the area are or eventually will be served by throw-over.

In the throw-over plan, two 13.8-kv feeders are brought into each switch through oil fuse cutouts mounted on the frame. The cutouts protect the switch and a single load. For two or more loads from each switch, an additional set of cutouts is installed for each customer.

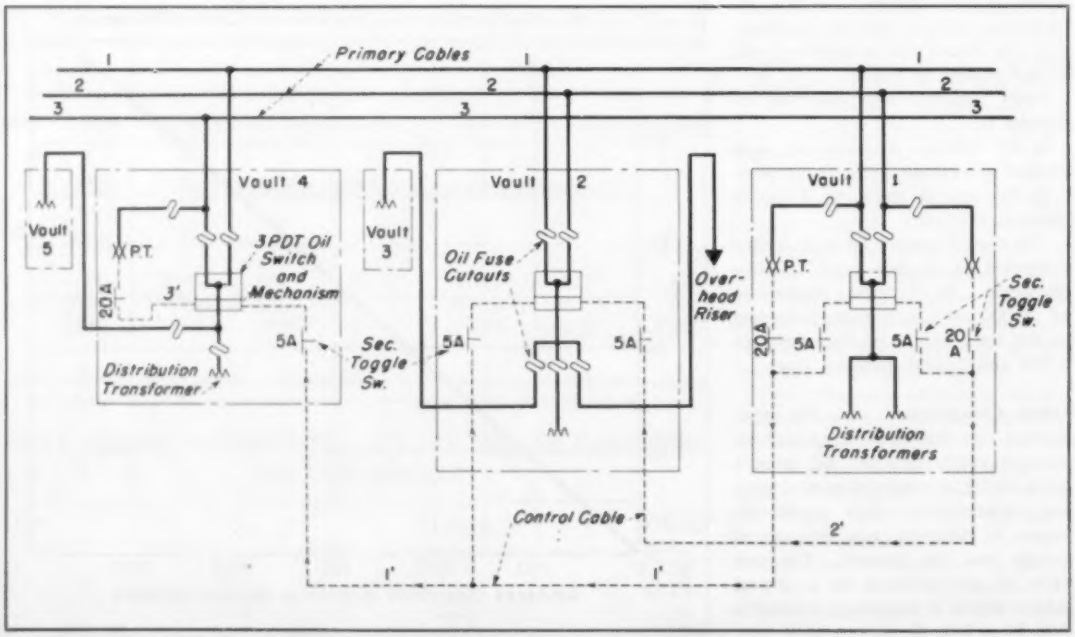
Emergency Operation Satisfactory . . . One circuit (preferred) normally serves the load or loads. When a fault occurs or the preferred feeder is de-energized, the switch automatically transfers the load to the other (emergency) circuit. A 2-sec delay before throw-over prevents operation of the switch during system disturbances or while the switch may be carrying fault current. The system is designed to operate satisfactorily in emergency with one circuit from each substation out of service.

When the preferred circuit is re-energized, the switch transfers the load from the emergency to the preferred circuit, the system being thus automatically restored to normal. A 2.5-min interval is required for the motor to compress the springs operating the switch so that throwback is not made immediately upon restoration of the preferred feeder and no "hunting" develops.

A potential transformer, protected by a cutout, is connected to one phase of each circuit to indicate loss of potential and to serve the motors in the mechanisms. Usually, one potential transformer is the preferred service for four to six switches over a No. 12 RINJ control cable.

Equipment . . . Equipment used by Florida Power & Light consists of the following:

1. Submersible oil switch, 400 amp, 15 kv, three pole, double throw, with self-supporting frame.



DISTRIBUTION DIAGRAM shows load served by 13.8-kv feeders through automatically operated submersible oil switches. **A feeder is brought into switch through oil fuse cutout; PT shows loss of potential and serves mechanism's motor**

Service

adding to it on Miami Beach

2. Automatic mechanism to throw switch from preferred to emergency, with time-delay relay and single-phase control.

3. Oil fused cutout, 200 amp, 8 kv.

4. Potential transformer, 7,620-240 v (or 13,200-250 v).

Typically, an oil switch, six cutouts, and the mechanism are installed as a unit in a space of 62 x 42 x 78 in.

Systems Compared . . . A 1951 study of the Miami Beach radial underground system compared automatic throw-over with the conventional 120/208-v network. Estimated costs showed the network plan would cost an additional $44 per kva for the original installation of 17,500 kva. This was based on kva costs of $26 for throw-over and $70 for a secondary network. The study showed that, in terms of total dollars, $2 million would be saved by throw-over.

Throw-Over Plan Cheaper . . . The lower cost of the throw-over plan was due in part to the following:

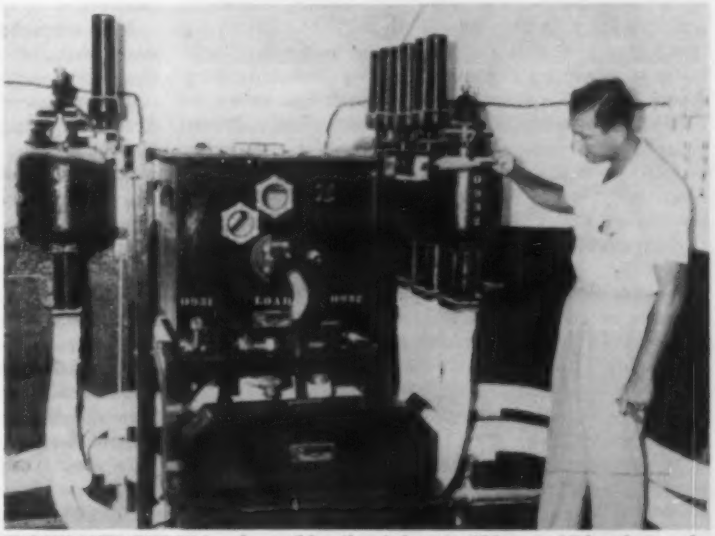
1. Use of existing transformer banks in the throw-over plan even though they were connected for 115/230-v service.

2. The need for long secondary ties in the network plan.

Primary cable and joint failures have increased steadily over the past ten years while underground transformer and secondary cable failures have decreased. This trend makes it very difficult to justify the additional protection of a secondary network compared with throw-over.

It has been the experience of FP&L that the 2-sec delay before throw-over is not objectionable to the customers served as the delay occurs only under fault conditions on the preferred feeder. During routine switching to clear a feeder for construction or maintenance, secondaries of the potential transformers for that circuit are de-energized manually before the station breaker is opened. This procedure results in only a momentary interruption, the outage being the clip-to-clip time of the switch, about 8 cycles.

"GOLD COAST" of Miami Beach, having a connected load of 32,500 kva, was the first area served through the throw-over method. It required 47 oil switches



THROW-OVER SWITCH is submersible oil switch type, 400 amp, 15 kv, three pole, double throw, with self-supporting frame, occupying about 62 x 42 x 78 in.

Platte Pipe Line's crude oil delivery is controlled from . . .

1,000-Mile Oil Pipeline Controlled

ALLEN R. HEIDEBRECHT, Chief Engineer, **FRED S. JONES**, Communications Superintendent, Platte Pipe Line Co, Kansas City, Mo.

Platte Pipe Line Co today employs microwave communications in the operation of its common carrier pipeline bringing Rocky Mountain crude oil to the St. Louis-Great Lakes region. Platte's microwave system consists of 45 repeater stations over slightly more than 1,000 path miles, and frequency-division multiplexing provides nine system-wide channels.

Two channels are for remote control, supervision, and telemetering; four support voice communications; and one channel each is used for teletype, VHF control, and remote repeater fault location. Complete RF standby equipment units assure high circuit continuity, and emergency engine generators provide continuous power service.

All remote control and supervisory information originates or terminates at Kansas City, Mo., the dispatching center. Telephone channels provide party-line service to dispatching personnel and administrative offices, and one channel is for private executive use. In effect, three types of information are carried by the microwave system, each contributing to the economic justification of the overall investment. These are communications, supervision, and remote control.

Communications and Supervision . . . Communication channels, necessary for point-to-point dispatching and general business, do not contribute greatly to warranting an expenditure for a large microwave system, such as Platte's. But supervision, including telemetry and remote indication, can justify such an outlay through increased throughput and efficiency.

By reading telemetered pressures from all stations in the system, the dispatcher can analyze the system at a glance. Accordingly, throughput efficiency can be increased to a point sanctioning the cost of supervisory equipment. For remote pipeline operation telemetering probably comes second in importance only to remote control functions.

When suction and discharge pressures from all stations are presented to him at his central location, the dispatcher can readily determine the operating conditions on the entire line. By noting pressure trends, he can predict operating requirements several hours ahead. With present and predictable information on hand he can employ telemetering to move more oil through the pipeline system.

Platte has the tone-duration type of telemetering, each station being equipped with transmitters which develop a tone of an "on" duration proportioned to the pressure. Tones are impressed on voice-frequency carriers for relaying to the dispatch center by microwave. At the dispatch center carriers are demodulated, and the tones impressed on frequency-responsive receivers activating telemetering receivers.

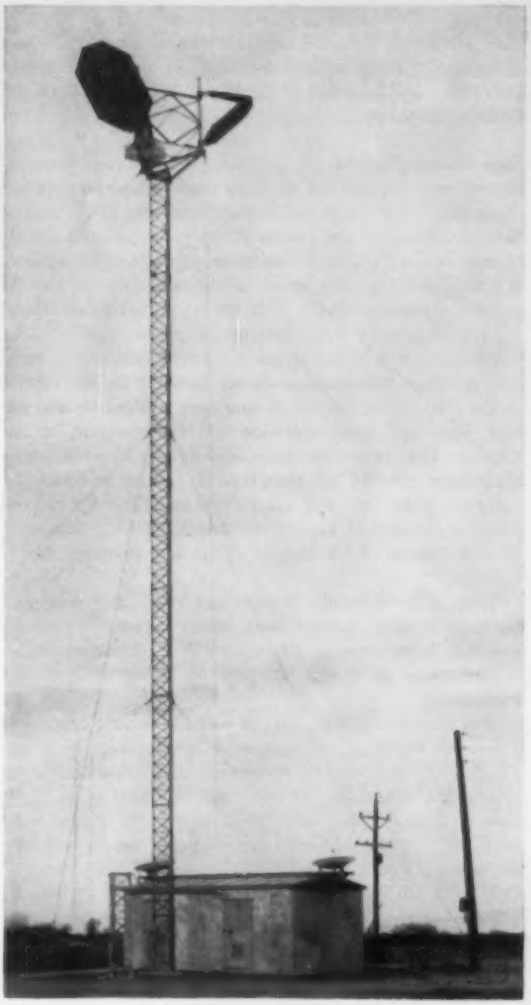
Some telemetered pressures are shown continuously on inked charts, others as called for on meters in the console. Generally, injection station discharge and booster station suction pressures are available on a continuous basis. Accuracies approaching 2% are quite feasible. In fact, Platte has found it relatively easy to obtain reading accuracies within the width of the recording pen.

Remote Control . . . Remote control probably makes the greatest single contribution toward justifying the large expenditure for a microwave system. Through an efficient control system, combined with the microwave system, remote stations are controlled from a central dispatching point at a great saving in station operating personnel. Remote control and supervision of the remote operation are accomplished through extended use of the microwave relay system which, in turn, supports a sequential five-tone control system.

To control one pumping unit or valve at a particular station, the dispatcher selects and operates a keyswitch on the dispatching console. This operation energizes the function selector circuitry which sets up a coded sequential tone train for transmission over the system. The sequential

Kansas City dispatching through . . .

45 microwave relay stations to . . .



by Microwave

code train contains station and function information and can be converted to function selection at only the designated location. By using four of five available tones on a sequential basis, the system can furnish many stations with many functions each while still providing for fail-safe operation.

Supervision is carried out by transmitting interrogation signals to particular stations and receiving present status signals from the interrogated station. Platte controls six booster stations with "on" and "off" selection of four pumping units and "open" and "close" operation of two valves. Remote control and supervision are highly conducive to economy in operating personnel, to synchronization of oil movements, and, most important, to increases in throughput efficiency.

Dispatching Console . . . Selector switches and operating keys controlling equipment at a remote station are mounted on the dispatcher's console. Indicating type telemetering receivers on which "as called for" telemetered values are registered are mounted there also.

The Kansas City dispatcher can operate valves, start and stop pumping units, and effect complete station shutdown at any of four stations on the west system or any of three stations on the east system. Continuous telemetering of pressure is received from each station on both east and west systems by use of separate audio tones and frequency-responsive units for each remotely read value. These values are registered on circular-chart recorders.

Certain pressure and tank-level readings, not continuously needed, are called for when required. Such readings, registered on indicator-type instruments, are interrupted by operation of the supervisory control equipment. Only one reading may be received at one time as the same tone channel carries all. This tone is one of several used for supervisory indications.

Tank-level telemetering takes only 15 sec to complete a set of readings, and during that time supervisory opera-

(Continued on next page)

pump stations like Caspar, Wyo.

Pipeline Puts Microwave System to Many Uses

(*Continued from previous page*)

tions are locked out. Oil storage tanks at Guernsey, Wyo., and Gurley, Neb., on the pipeline, are gauged remotely although local readings of the liquid levels of the tanks can also be taken.

Supervisory Control . . . Platte's supervisory control system uses a coded sequence of four audio tones for an operation. One signal is transmitted at a time, with a no-signal space of approximately 0.1 sec separating signals to permit auxiliary relays to drop out. Each signal lasts 0.4 sec, and any one signal in the sequence of four is never followed by itself. This obviates momentary interruption of a signal being interpreted as two signals.

When more than one signal is received during an operation or when spurious signals are induced on the carrier of the microwave, the entire operation is blocked; and the blue light indicating initiation of the operation is not lighted. The dispatcher then releases the keyswitch and tries again. Should less than four signals be received, the complete chain of four relays for operating interposing relays is not picked up. Should one signal fail, causing a no-signal space of 0.6 instead of 0.1 sec, the operation is cancelled.

Thus a predetermined sequence of four single frequencies with a definite time space between signals is essential to perform an operation. A complete operation is performed in 2 sec plus the operating time of the equipment.

Several requirements must be met for remote control of a pumping station miles from a central control point. Functions which can be performed via the basic control system are limited to "on" or "off" positions of a simple switch or relay. The station must be capable of automatic operation within itself, the control point merely selecting the operating conditions.

Sequencing . . . To energize a pumping station and insert it into the line, only one relay is closed by remote control. This relay initiates a sequence of operations inserting the pumping unit into the line. When the remotely controlled relay operates, another relay is energized, thus setting up a chain of events which open the suction valve, crack the discharge valve, start the motor, and signal the remote control point when the unit is on the line.

In de-energizing the pumping unit, the remotely operated relay sets up a reverse chain. Normally this takes the unit off the line with minimum delay. Automatic sequencing offers several advantages over operator control, most notably automatic and uniform timing.

Servo System Proves Practicable . . . Initially Platte engineers provided for control of operating conditions at distant stations by remote operation of a main-line discharge valve. Suitable controls were added to open or close the valve in incremental steps.

When experience proved the inadequacy of this system, Platte decided to utilize a feed-back loop or servo system of control to provide the interior automation of their booster stations. This new system now makes fully automatic operation practicable.

Platte's six newest stations were designed for fully automatic operation so that all changes in throughput are governed from Kansas City. This was done by using automatic electronic process controls.

Protection . . . Only a minimum of fault information is transmitted by microwave. To telemeter all station faults would greatly increase the cost of multiplexing; so only a complete unit shutdown is telemetered, and a resident station operator or traveling technician analyzes the fault. Each individual booster unit responds to a sequencing scheme. All elements of this arrangement may be expected to perform only when all items of protection equipment present affirmative operating conditions.

Any one of the following faults returns the sequence relays for a booster unit to their non-operating positions:

1. Motor overload.
2. Motor feeder line short circuit.
3. Excessive motor bearing temperature.
4. Excessive pump case temperature.
5. Centrifugal pump seal failure.
6. Individual pump low suction pressure.
7. Individual pump high discharge pressure.

Other protection items will be added as needed. Platte engineering and operating groups intend to consider refinements in operating equipment for application as industrial research progresses. It has been proved repeatedly that economies can be effected with properly applied automation.

Additions Considered . . . Additional features under consideration include:

1. Recording oil gravities at the dispatch point. Gravitometers and associated in-station telemetering equipment have been added recently to one station for transmitting gravity to the dispatch point.

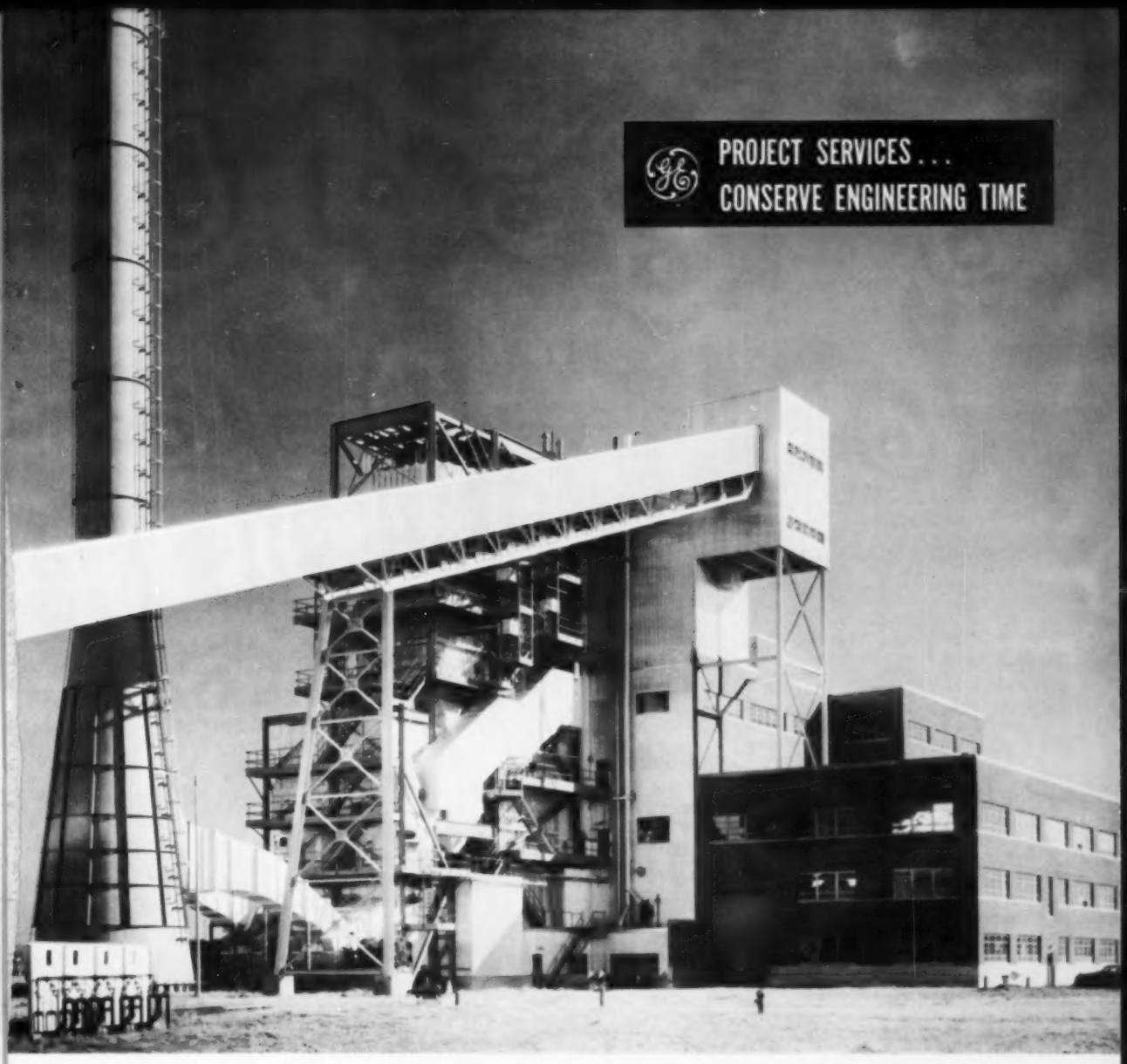
2. Automatic control of batching from gravity and/or interface detection. Installed gravitometers and telemetering equipment offer opportunities for automatic tank switching. The integrated change in mechanical displacement of the recorder or electrical characteristics of the transmitted information can be applied directly to a valve-control system.

4. Station shutdown in the event of downstream line breaks. Downstream line breaks are revealed by loss of discharge pressure or rapid flow changes. Platte may explore the addition of electronic or mechanical differentiators to discharge controllers to sense rapid changes of operating conditions, such as changes of flow or pressure.

5. Interface detection. At points other than pump stations, interface detection could be used to great advantage in determining line rate (flow) and interface spread.

6. Elimination of pneumatic-powered pressure regulating valves. New electronic controls for station output pressure have promoted interest in the replacement of the pneumatic-powered valve.

7. Automatic reduction of pumping equipment as needs decrease. Automatic pressure-valve control would work ideally, if pumping units could be de-energized and energized as needed. Electronic control now being installed in new stations is adaptable to such an option, and Platte hopes that it can soon implement such a program.



Iowa Power & Light steps up system capacity by 44,000 kw with G.E.-equipped Council Bluffs plant

Continued rapid growth of Iowa's industrial and residential load pointed to the need for increased generation facilities in western Iowa. With boldness and foresight, IPALCO climaxed a four-year expansion program with the new Council Bluffs steam station. This 9½-million dollar investment provides an increase in system capacity of 44,000 kw.

Working closely with Black & Veatch, Consulting Engineers, and IPALCO, General Electric assigned a project team to the Council Bluffs station to give valuable assistance in helping to keep construction abreast of schedule and holding total cost within budget restrictions.

GENERAL ELECTRIC

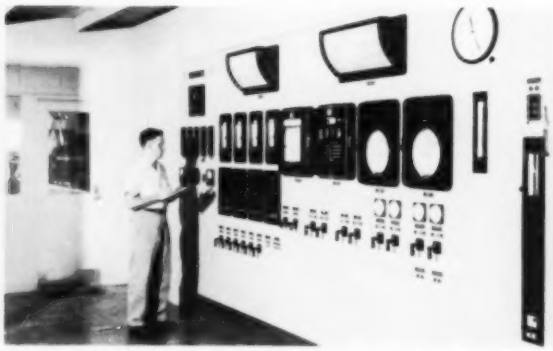
For more station data see next page ►

PROJECT SERVICES REPORT:

44,000 KW TURBINE-GENERATOR helps IPALCO meet growing power requirements. The General Electric project team met all specifications and coordinated related equipment design details for IPALCO, Black and Veatch engineers.

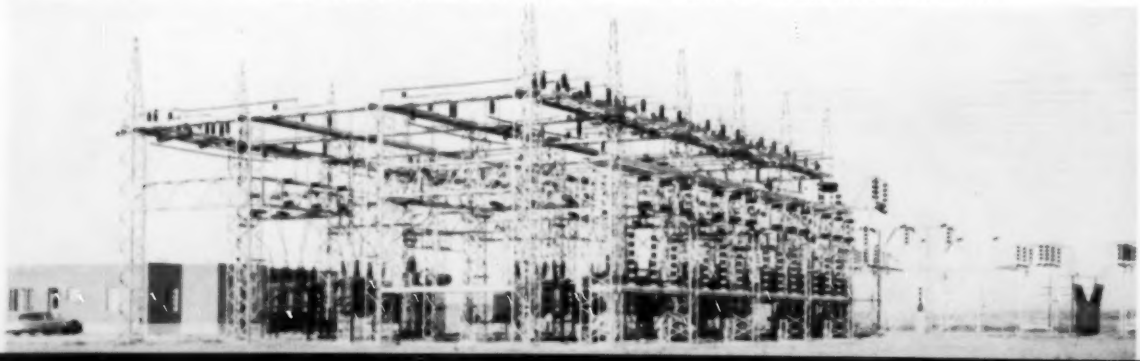
G. E. helps IPALCO, Black & Veatch cut

FIRST STEP was conference of F. A. Beaty, IPALCO V. P. (left); R. H. Miller, G. E.; and N. Bernard Gussett, Pres. of IPALCO.

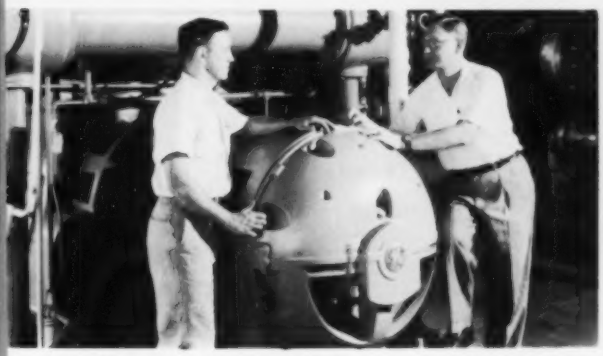


PACKAGED CONTROL BOARD enables operators to secure maximum benefits from station's flexible design.

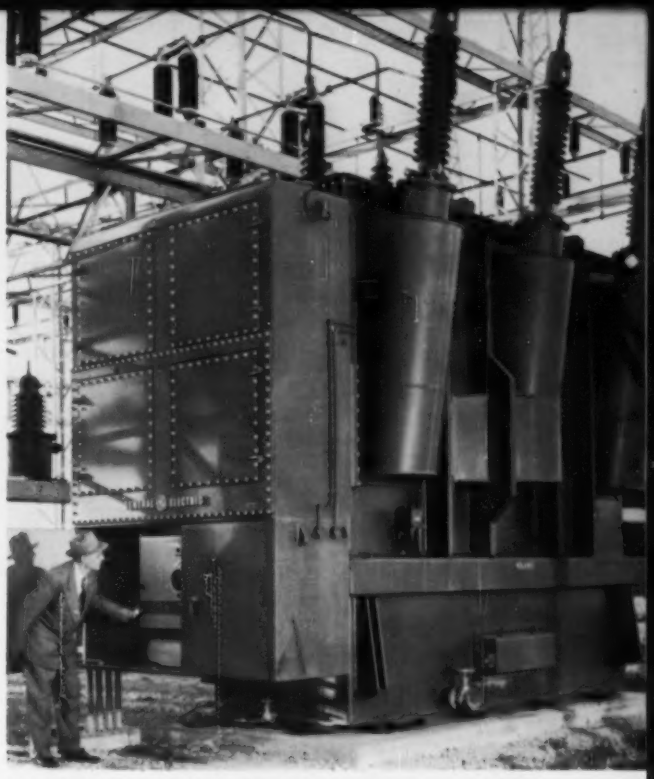
COMPLETE SWITCHYARD including structural steel was supplied as a unit through General Electric Project Services.



PERIODIC REVIEW of station design by (l to r) G. E.'s N. R. Schultz and T. O. Millard; B&V's R. C. Oliver, Jr.; IPALCO's A. J. Adams, helped solve problems, cut engineering time.



SUPERVISED INSTALLATION of equipment such as this compressor motor by G-E engineers helped assure coordination.



ON-SCHEDULE DELIVERY of this 41,667 kva power transformer, being inspected by Clarence Talsma, helped meet start-up date.

engineering time on Council Bluffs unit

Project team links apparatus details to over-all planning, frees utility and consultants for more important duties

When Iowa Power & Light and Black & Veatch selected General Electric apparatus, the G-E team assigned to the Council Bluffs project marshalled the company's vast development and manufacturing facilities. As a result, product engineering time was held to a minimum.

This team, headed by the G-E sales engineer assigned to Iowa Power & Light, was able to coordinate all electrical apparatus detail work, freeing IPALCO and B&V engineers for the project's more important phases. Many factors, such as changes in the design of one item of electrical apparatus requiring modification of other electrical equipment, were coordinated by the G-E project team.

Such teamwork, combining the utility, the consultant, and G-E's team of sales engineer, product specialists, application engineers, order service coordinators, and field service engineers, can save you time, money and man-hours. Here's how it's done:

SIMPLIFY ORDERING OF EQUIPMENT, purchased either directly, or through your consulting engineers, or through a machinery manufacturer.

CONSERVE ENGINEERING TIME by handling electrical details which frees you and your consulting engineers for other urgent problems.

INTEGRATE EQUIPMENT DESIGN to assure the maximum flexibility and effectiveness of plant operation.

SPEED CONSTRUCTION by scheduling the arrival of equipment for maximum installation efficiency.

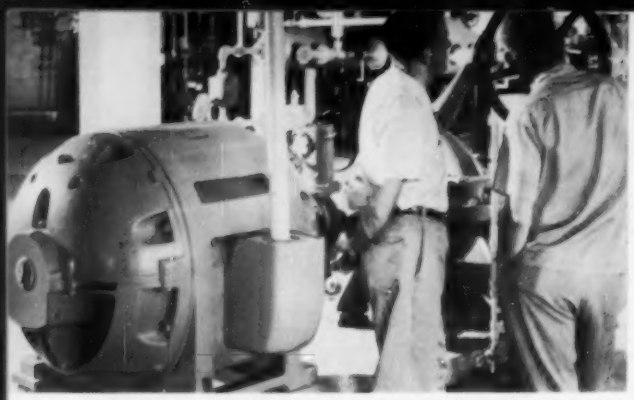
ASSIST IN INSTALLATION AND IN TRAINING OPERATORS to assure minimum start-up time and better understanding of the full operating capabilities of the equipment.

For details contact your General Electric Apparatus Sales Representative or write Section 302-6, General Electric Company, Schenectady 5, N. Y.

More Power to America

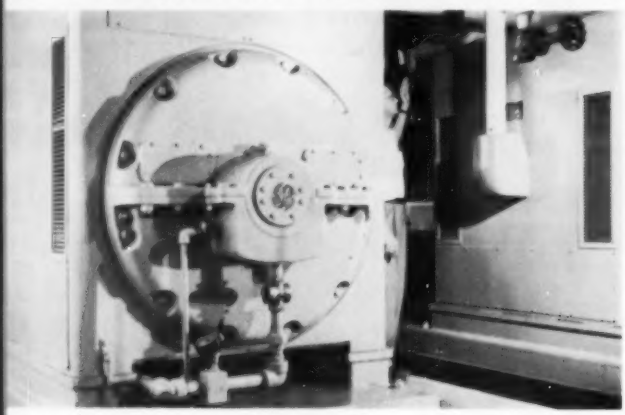
GENERAL ELECTRIC

See next page for more data on Project Services ►

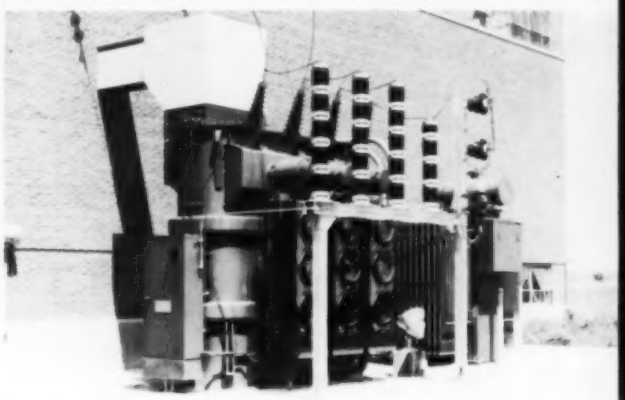


PROPER SELECTION of all apparatus from turbines to this G-E ash sluice pump motor is but one of many advantages of G-E project services coordination.

COORDINATED DESIGN of equipment was checked here by E. W. Springer, G. E.; F. W. Motley, B&V; F. L. Sargent, B&V; and J. T. Tengdin, G. E., Kansas City office.



SCHEDULED MANUFACTURE of these G-E boiler feed pump motors, with overhead exhaust, was closely synchronized with Council Bluffs construction progress.



ON-TIME DELIVERY of these G-E 50,000 kva main power and 5,000 kva station power transformers and the lightning arrester protection system helped eliminate costly delays.

How G-E project coordination helps keep plant construction progress abreast of schedule

From the preliminary planning stages in your project, General Electric engineers can help you and your consultants by setting up an apparatus timetable. With start-up commitments in mind, G. E. schedules the design, manufacture, and shipment dates of all electrical apparatus to coincide precisely with the time at which they will be needed at your construction site. This service helps prevent disrupting of construction schedules and sound financial planning because of early or late shipments.

Project coordination is just one of many Project Services on your job when you or your consultant specifies G-E equipment. You take advantage of all these services with G. E.:

APPLICATION ENGINEERING helps assure all electrical equipment is coordinated in design and operation to best suit the requirements of your plant.

PRODUCT DEVELOPMENT ENGINEERING means equipment design which reflects both field experience and laboratory achievements.

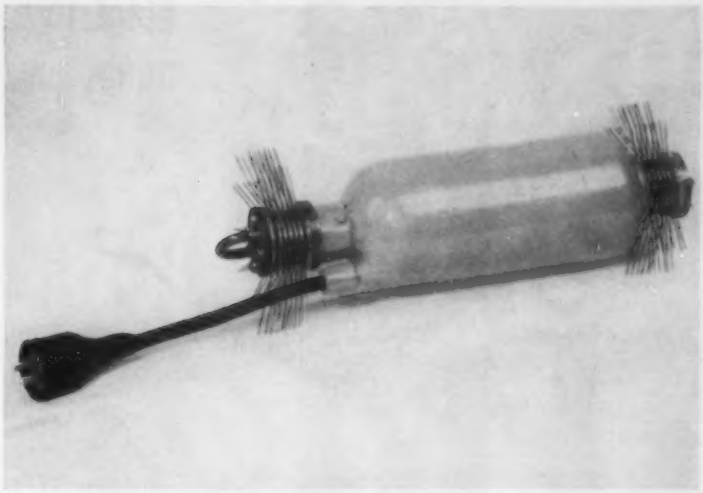
FIELD SERVICE ENGINEERING means supervised installation, planned start-up, proper operation of equipment.

SERVICE ENGINEERING helps keep plant operating at full capability, means expert training of operators, setting up of maintenance programs.

PROJECT COORDINATION helps assure proper selection, design, manufacture, delivery of your equipment without costly delays at installation time. 302-6

More Power to America

GENERAL ELECTRIC



Vibration of eccentrically weighted motor causes bristles to dig into conduit wall as . . .

Electric "Mouse" Rods Ducts Faster, Cheaper

An "electric mouse" used by Con Edison is successfully rodding underground ducts faster and cheaper than the old method. This device developed by C. P. Xenis was demonstrated at the recent EEI Transmission and Distribution Committee meeting in Washington, D. C.

The "mouse" is a self-propelling device, consisting of a pair of cylindrical wire brushes and a specially designed electric motor. Eccentric weights embedded in the motor at each end impart a vibrating motion which is transformed into forward motion as the brush ends dig into the conduit walls. The four in. duct model weighs about seven lbs and wiggles through the conduit at a rate of about 3 ft a sec.

A rubber insulated cable about 500 ft long and ⅜ in. in diameter, containing two conductor wires and two stranded steel wires, is connected to the tail of the "mouse." The cable pulls a steel pulling cable which in turn is used to pull in the electric cable.

Minor obstructions or water in the duct do not impede its operations. Should the "mouse" be stopped by a major obstacle, it can be pulled back out of the duct by its "tail." This is accomplished by exerting a pull on the cable that causes the brush bristles to point in the opposition direction. After this initial pull has changed direction of the bristles, the "mouse" can be retrieved with a pull of about 25 lbs. The device can be used in either steel, transite, or fibre ducts.

The motor is rated at ⅓ hp and operates at 120 v. It is totally enclosed and waterproof. Because it lacks ventilation, it can be run for a limited time only. Safe running time is 7 min. Duration of the longest run to date has been 3½ min. About 175 ducts have been threaded with the "mouse", total pulling length amounting to about 45,000 ft. Longest pull has been 580 ft.

Motor traction can be increased by connecting two motors in series.

Actually dimensions of the motor assembly depend on the power requirements and the dimensions of the conduit bends to be encountered. Increasing the motor length requires a reduction in its diameter.

The device used in the 4-in. duct is 3 in. in diam and 10¾ in. long. Its brushes, or tines, are made of steel music wire .032 in. in diam, 4⅛ in. long, and anchored to an aluminum core. Diameter of the brushes is a little more than the inside diameter of the underground duct. Brushes are replaceable and are usually good for 5,000 ft of pulling.

The "mouse" for the 3 in. or smaller duct has not as yet been fully developed.

Dual Drive Pump Gives Standby Service

A dual drive fuel oil pump is providing successful standby service for the City of Burbank's municipal power plant to insure continuous boiler operation during electric power interruptions. The pump is mounted on the same shaft with a 50-hp motor and a turbine. The turbine is supplied with steam at 250 psi. This pump, its motor, and turbine is the standby unit that substitutes for a sister pump-motor-turbine unit should it fail.

The turbine provides additional insurance against interrupted service. It is normally driven by the motor on the common shaft with the pump. If the pump speed drops 150 rpm below the normal motor speed of 1,150 rpm, the turbine governor opens the steam

(*Continued on page* 78)

EXPANDED RANGE OF KV RATINGS

W. J. Rudge, Manager Lightning Arrester and Cutout Engineering, foreground, and R. T. Morris, Manager Lightning Arrester and Cutout Sales, background, inspect expanded range of ratings of General Electric's all-new Line-type Arresters.

ALL-NEW SERIES OF LINE-TYPE ARRESTERS

NEW! Expanded range—ratings 3 through 121-Kv

NEW! 20% better protective level

NEW! Magne-valve action in line-type arresters

Here is General Electric's new series of THYRITE* Magne-valve line-type arresters —revolutionary in design, exceptionally high in co-ordinated protective efficiency and in endurance. Seven new standard arrester ratings have been added to broaden the new line from 3 through 121-Kv.

Exclusive Magne-valve action is the key to the superior performance characteristics of this new arrester. This is accomplished by *magnetic* action of the series gaps aided by *valve* action of improved Thyrite valve disks. Already successfully applied to G.E.'s new THYRITE station-type arresters, and thoroughly proved since 1950 by thousands of service operations, Magne-valve action now applied to new line-type arresters means far higher reliability. For example:

BETTER PROTECTIVE LEVEL—Has 10% lower impulse sparkover voltage and 20% lower IR discharge voltage (see graph below)—representing a degree of protective efficiency *heretofore unobtainable in any line-type class of lightning arrester.*

LIBERAL DISCHARGE CAPACITY—Easily withstands the industry-standard long duration current test, as well as the industry-standard high current test of 65,000 amperes (5x10 ms wave).

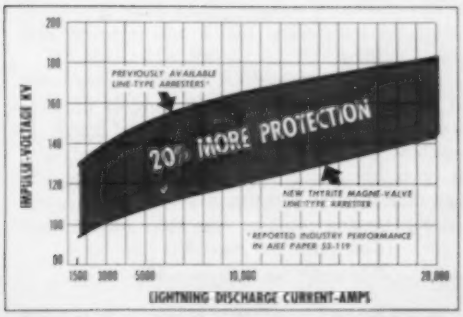
MORE STANDARD RATINGS FOR MORE APPLICATIONS—At numerous small or medium sized transformer substations, or switching substations, small sizes of metal enclosed switchgear (where limited space has heretofore been a problem), and at load centers.

G.E.'s new series of Thyrite Magne-valve line-type arresters is already a service-proven product available for your system. For full details, including performance data, check your nearest G-E Apparatus Sales Representative or write to General Electric Company, Schenectady 5, New York. Ask for Bulletin GEA-2978. 433-12

*Registered Trademark of General Electric Company.

Progress Is Our Most Important Product

GENERAL ELECTRIC



20% MORE PROTECTION compared to latest industry performance characteristics.

GAP UNIT with magnetic coil and pre-ionizing elements interrupts arc in less than half a cycle.

LOOSE GRAIN IMPULSE TESTING under pressure assures uniform quality of Thyrite disks.

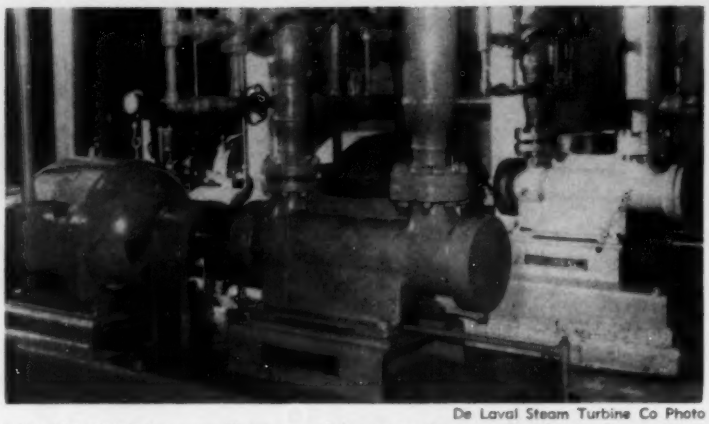
Dual-Drive Pump

(*Continued from page 75*)

throttle valve and the pump speed is therefore maintained by means of the turbine drive.

In order to protect the pump and motor from overload shock, following starts with cold and viscous oil, the pump is accelerated slowly by the turbine. When the speed reaches 1,000 rpm, the motor is cut in, and the turbine governor automatically closes the throttle valve, stopping steam flow to the turbine.

The standby pump is always kept warm and idling. This is done by allowing the discharge pressure from the operating pump to bypass the standby pump discharge check and stop valves, and slowly drive the standby pump in reverse. In summer, during periods of gas firing, both pumps are idled in a similar manner by a smaller oil pump. This pump circulates 10 gpm of fuel oil through the main pumps in a reverse direction. The fuel oil system is thus kept ready in case of failure to the gas system.



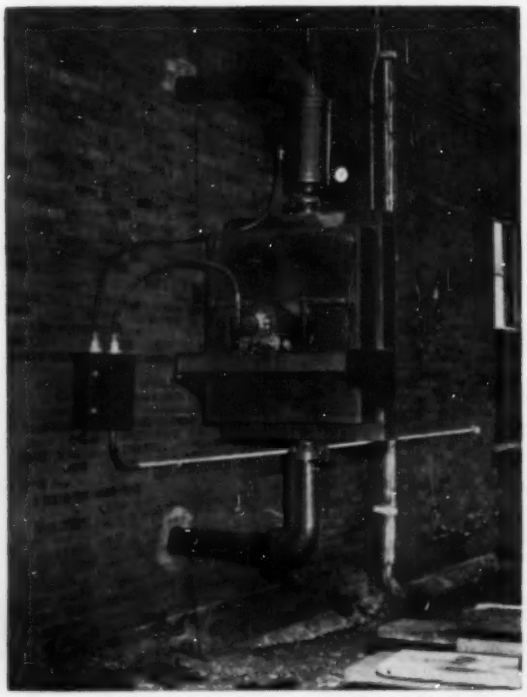
De Laval Steam Turbine Co Photo

FUEL OIL PUMP is normally powered by motor but can be driven by a steam turbine if motor fails. Changeover occurs when speed drops to 1,000 rpm

Electro-Cooler Boosts Old Transformer's Capability

HARVEY C. SARGENT, General Superintendent, Superior Water & Light Co, Superior, Wis.

Installation of an electro-cooler on a 1912-vintage 4,500-kva transformer restored capability to 6,000 kva, without exceeding the maximum permissible top oil temperature of 70C. The transformer is rated 4,500 kva, 25 cycle, 3 phase, 33/66-13.2 kv.



ELECTRO-COOLER boosted transformer capability from 3,500 to 4,500 kva and with heat exchangers to 6,000 kva

Water tubes of the transformer cooling system failed in 1940. They were replaced with four oil-to-air heat exchangers but these were not large enough to handle maximum loads in hot weather. Calculations had been based on original core loss figures supplied with the transformer. But core losses had increased due to aging of steel and the small heat exchangers.

To add more cooling capacity at minimum cost, an electro-cooler was purchased. It was installed without removing all the transformer oil and without untanking the core and coils. Oil was drained from the transformer tank to lower the level about one foot, without uncovering the windings.

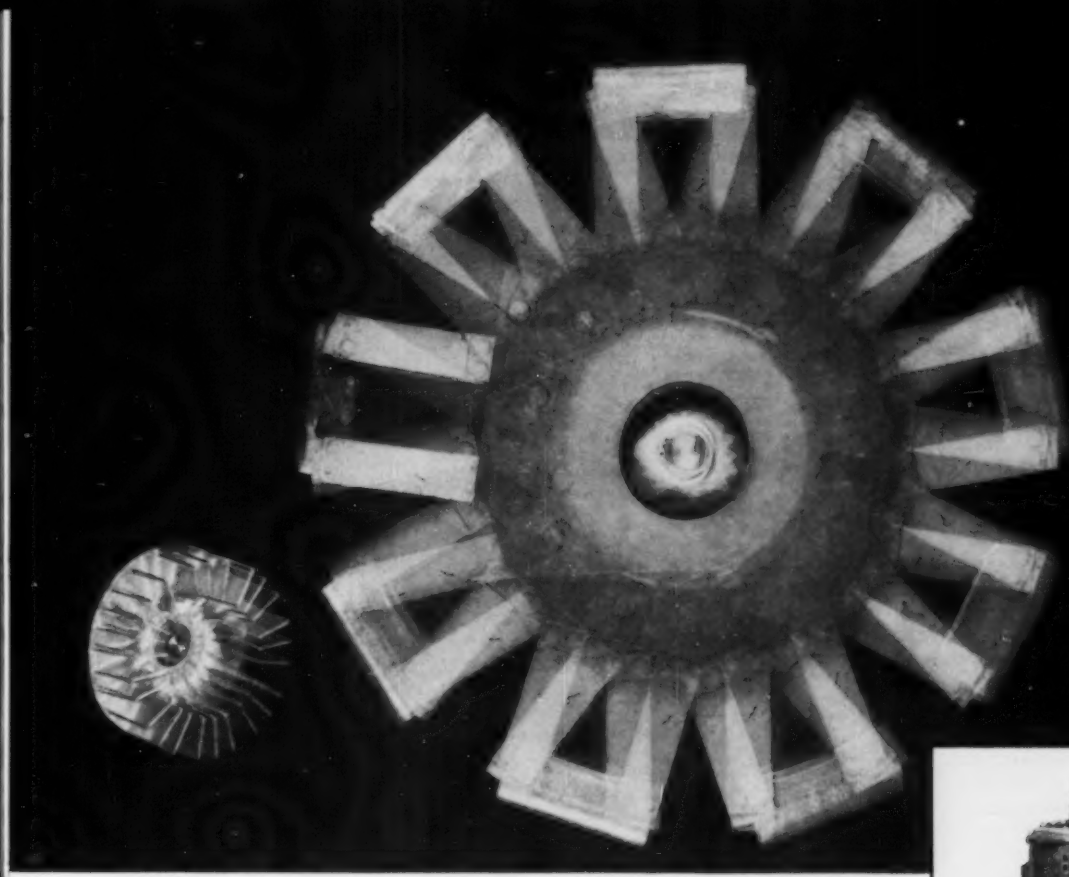
The hand hole on top of the transformer was then opened, and a workman fastened a 5-qt tin can, with duck seal, over the spot inside the tank where the suction (top) pipe connection was to be made. An acetylene torch was used to burn the suction opening into the tank, and a flanged nipple was electrically welded over the opening.

The tin can prevented welding sparks from igniting or contaminating the transformer oil. It was removed after completion of welding.

Making the lower oil connection required more work. A flanged nipple was welded to the outside of the tank and a special tapping valve was bolted on the flange. A tapping machine was then bolted to the valve; and, with the valve open, the cutting head of the machine was put through until it touched the tank.

Stem of the tapping machine was then rotated until

(*Continued on page 80*)



STROBOSCOPIC PHOTO of spinning paddle wheel (left) and rotating tap changer on G-E ML32 regulator.

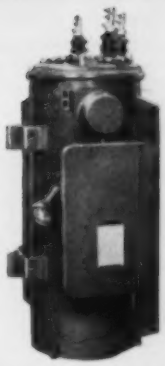
DOES YOUR SUPPLEMENTARY REGULATOR HAVE

"Bounce-free" switch action for lower maintenance cost

Here's *another* important General Electric voltage regulator feature that appreciably lengthens contact life—reduces maintenance expense. The secret: "Bounce-free" Opti-Life switching, which makes the contacts glide into the next tap position.

See that little paddle wheel in the photo, at the left of the switch? It acts as a speed-controller to minimize erosion as the contacts part. You get an optimum speed . . . not too fast, not too slow. Also, entry into the next position is smooth, positive, with no life-reducing bounce. This little Opti-Life impeller has helped extend contact life to over *five times what it was ten years ago!* It's an exclusive feature of G.E.'s ML32 single-phase step voltage regulator for supplementary service.

12 more features, many just introduced into the 1955 ML32 feeder voltage regulators, mean greater accuracy, longer life, superior service. They add up to the most advanced supplementary regulator available today. General Electric Company, Schenectady 5, New York. 423-6



ONLY THE ML32 GIVES YOU ALL THESE FEATURES

Greater Accuracy

Class 1 Control Accuracy
Control Dial Locking
Control Test Rheostat
Rheostats For LDC Adjustments

Longer Life

Opti-Life Tap Switching
One-Piece Cover Band
Super Melaglyp Paint
Nitrile Rubber Gaskets
Electrostatic Shielding

Superior Service

Flat Upper VRR Contacts
Up To 120-Sec. Time Delay
Handy Meter Shelf
Internal By-Pass Protection

Progress Is Our Most Important Product

GENERAL ELECTRIC

Transformer Electro-Cooler

(*Continued from page* 78)

a round section was cut out. As the cutting head was backed out, it removed the circular piece of steel, and oil washed out the steel chips that resulted from the cutting operation. After the tapping valve was closed, the tapping machine was removed, releasing about two gal of oil from the tapping machine.

Oil pipe-lines were then connected to the electro-cooler, located on the outside of the building, to complete the installation. Oil is pumped from the top of the transformer, through the electro-cooler, and back to the transformer through the bottom connection. The centrifugal pump and one-hp motor are enclosed within the oil line. Fan on the cooler is driven by a one-hp motor.

The cooler dissipates 50 kw of heat when the incoming oil temperature is 35C above ambient.

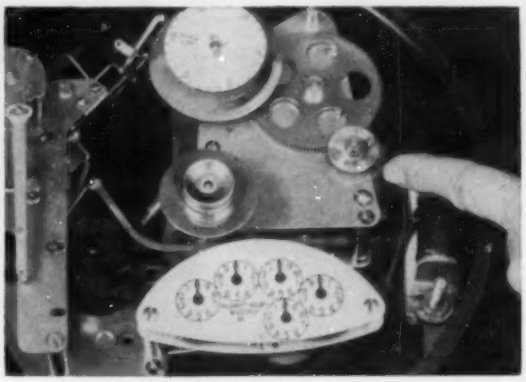
Before the cooler was installed, maximum load for the transformer was 3,500 kva without exceeding the 70C permissible top oil temperature. Now, by using the electro-cooler alone the capability is 4,500 kva. With both electro-cooler and the heat exchangers the transformer capability is 6,000 kva.

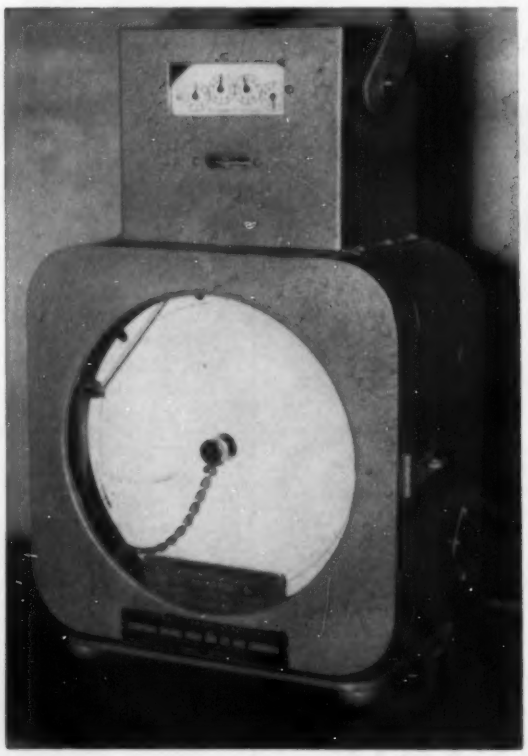
Clutch Speeds Chart Setting

J. F. BAKER, System Meterman, Potomac Edison Co, Hagerstown, Md.

A simple clutch installed on G9 demand meters eliminates waiting for the exact hour or half-hour for setting the chart. It also permits more accurate setting. The modification is made by removing the motor pinion and installing a clutch costing $1.10. Installation time is about 20 min.

With this arrangement the chart is set on the nearest hour and then the interval cam is turned the proper number of minutes. This causes the chart to be turned to the proper time because the interval cam and chart hub are geared together.





Demand-Watthour Meter Records Appliance Load

M. D. JESTER, Central Power & Light Co, Corpus Christi, Texas

Demand and kilowatthour load characteristics on customer appliances is being obtained with a combination meter. The terminal chamber of the thermal demand meter was sawed off, and a watthour meter element housed in an aluminum box, 5½ x 6 x 4½ in., was mounted on top of the demand meter.

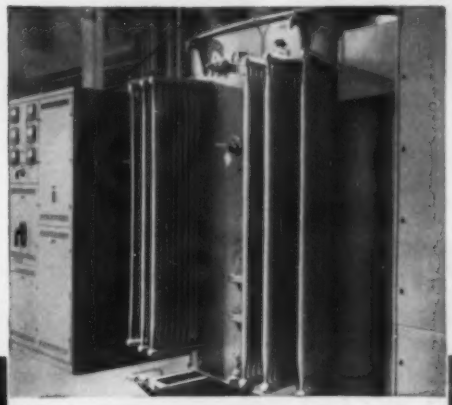
Connections for either two or three wires were arranged so that the instrument can be plugged into the appliance circuit. Several lengths of extension cord make it possible to spot the meters in an out-of-the-way place. This makes a compact unit, and there have been no objections from home owners about their use.

DEMAND AND WATTHOUR meter combination was made by mounting watthour meter on top of thermal demand meter

(*More How To on page* 84)

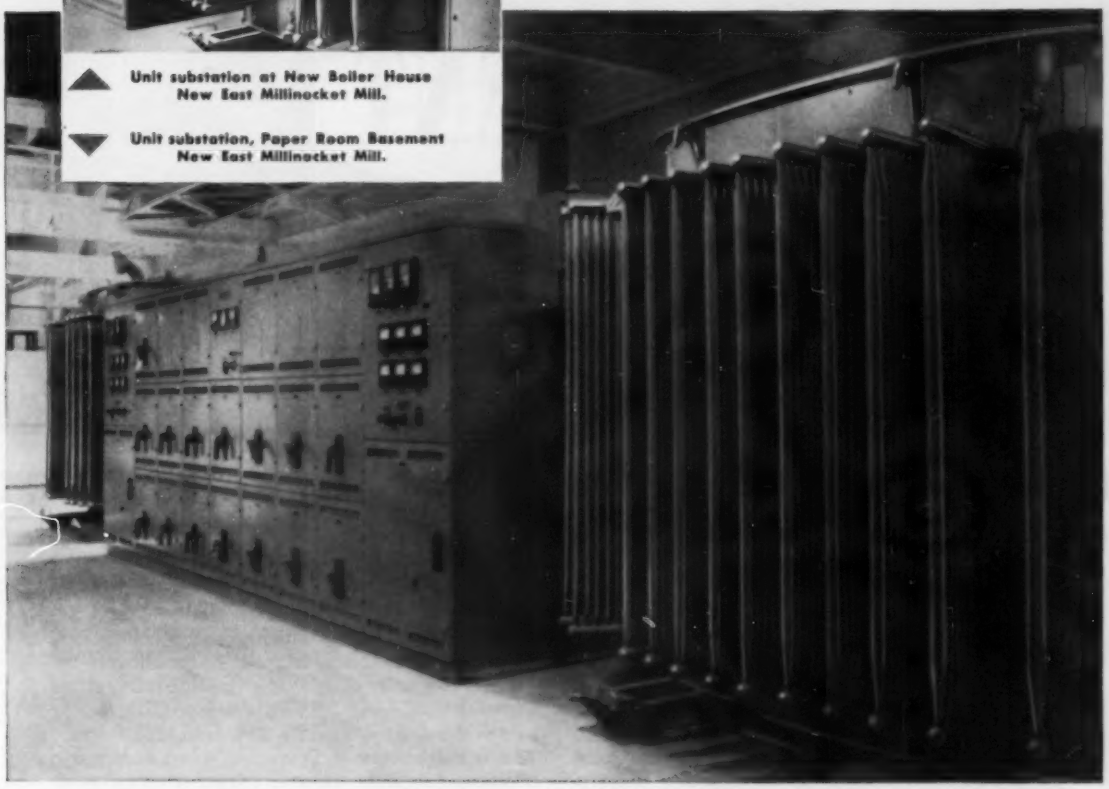
10 PENNSYLVANIA UNIT SUBSTATION TRANSFORMERS

help supply the power requirements of Great Northern Paper Company's East Millinocket Plant



▲ Unit substation at New Boiler House New East Millinocket Mill.

▼ Unit substation, Paper Room Basement New East Millinocket Mill.



Seven 2000 Kva and three 1000 Kva Pennsylvania Askarel transformers are supplying power to all of the 550-volt motors used by Great Northern Paper Company in the manufacture of paper at its new Millinocket plant. Protected by Askarel, Pennsylvania's non-inflammable cooling and insulating liquid, these transformers are important components of I-T-E unit substations. They assure an uninterrupted flow of power from the 69,000-volt power system to the 575Y/332-volt distribution system. All transformers are 3 phase, 55°C. temperature rise and operate at 40 cycles.

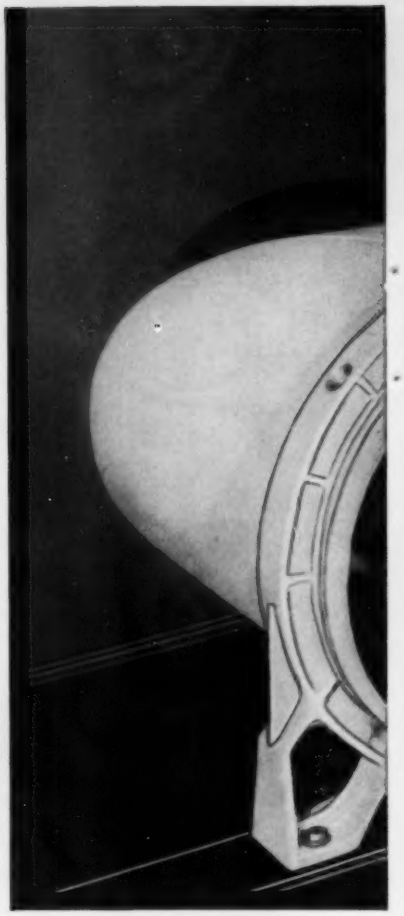
PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division

CANONSBURG, PENNSYLVANIA • ***Greater Pittsburgh District*** • **Telephone: SHerwood 5-9100**

NEW

REMARKABLE DEVELOPMENT by DELTA-STAR!



Metal enclosed isolated phase bus structures

Here's Delta-Star's new engineering achievement in metal enclosed bus structures! New design permits easy, economical installation. New telescoping covers save time and money on inspection and maintenance.

Installation is simplified by *eliminating all bolted covers.* Instead, telescoping covers are clamped in position and locked with two screws. Longitudinal sections 6 to 8 ft. long can be pre-assembled and shipped in lengths as large as your facilities can handle. Pre-assembled conductor joints are pre-welded. Corners and tees are shipped *complete* with bus and insulators. *There are no longitudinal gaskets to cut and install.*

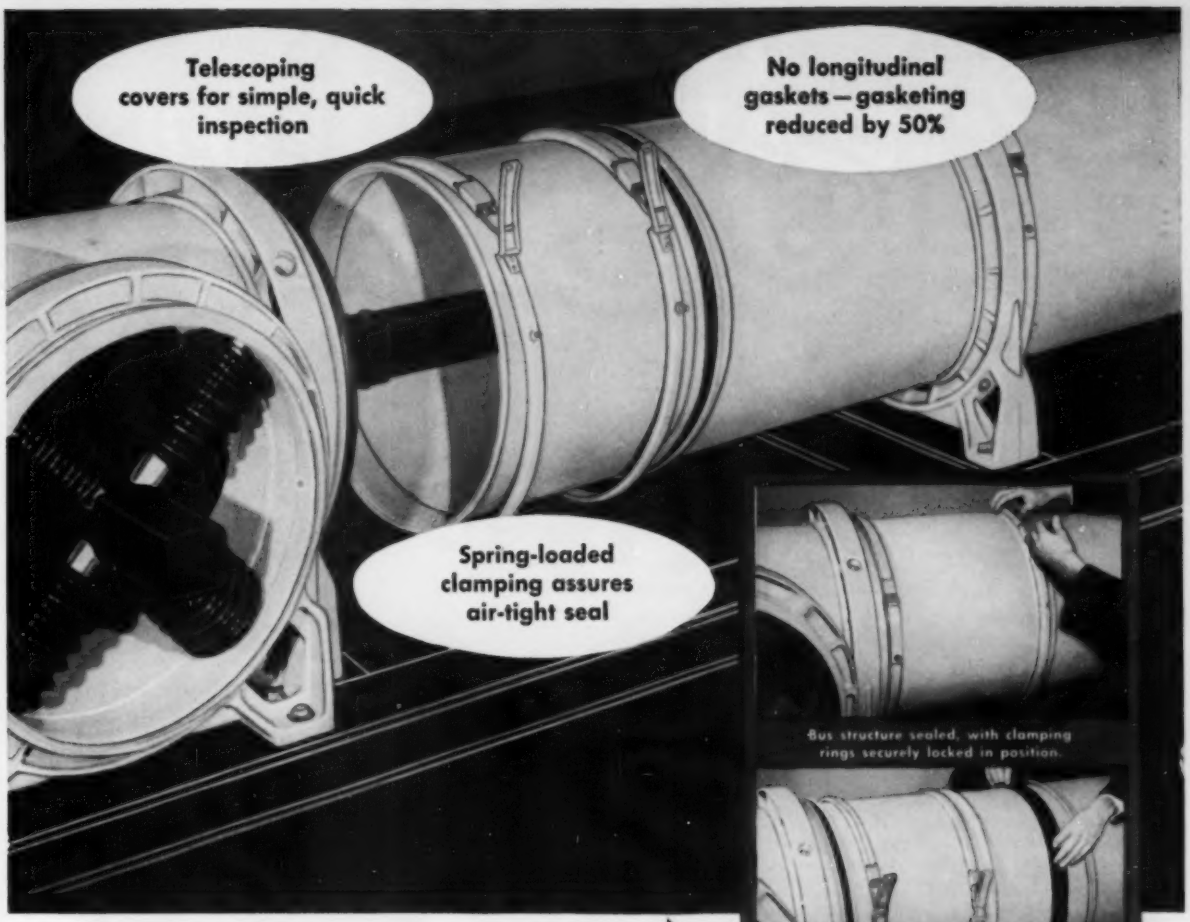
With telescoping covers, bus sections can easily be inspected, without tools. Simply remove two nuts which lock the clamping rings in position, then slide the telescoping cover out of the way. There's 2 ft. 6 in. open space for maintenance and cleaning when necessary. When cover is closed, toggle clamps with compression springs maintain constant pressure. Neoprene gaskets assure tight seal.

Cross section of telescopic cover, showing (A) cast aluminum ring, (B) removable clamping rings, (C) Neoprene gaskets and (D) sliding ring. Notice elimination of longitudinal gaskets.

Welding affords more rigid support for round enclosures—no need to depend on small cover bolts. No ring gaskets required.

Foolproof circular extruded gaskets for airtight seal. Fully trapped and self-seating.

Heavy extruded gasket forms insulation to limit flow of sheath current.


Telescoping covers for simple, quick inspection
No longitudinal gaskets—gasketing reduced by 50%
Spring-loaded clamping assures air-tight seal

with telescoping covers

All sections are one piece and tubular in cross section. Thus they offer maximum strength against both internal and external pressures. Circular gaskets are fully trapped and self-seating. They protect against the elements, moisture and dust. Supporting rings of high strength cast aluminum alloy are welded to stationary tubular sections, affording rigid support for enclosures and eliminating the need for ring gaskets at these points.

For complete information about this new metal enclosed bus structure, be sure to talk to your Delta-Star representative. Or, write for Bulletin B.

Bus structure sealed, with clamping rings securely locked in position.

Clamping rings unfastened, ready for telescoping cover to be moved.

Cover slid back, open for bus inspection. Opening accomplished in 30 seconds!

For the best in high voltage electrical equipment—specify DELTA-STAR

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.
OF PITTSBURGH
2437 Fulton Street • Chicago 12, Illinois
District Offices in Principal Cities

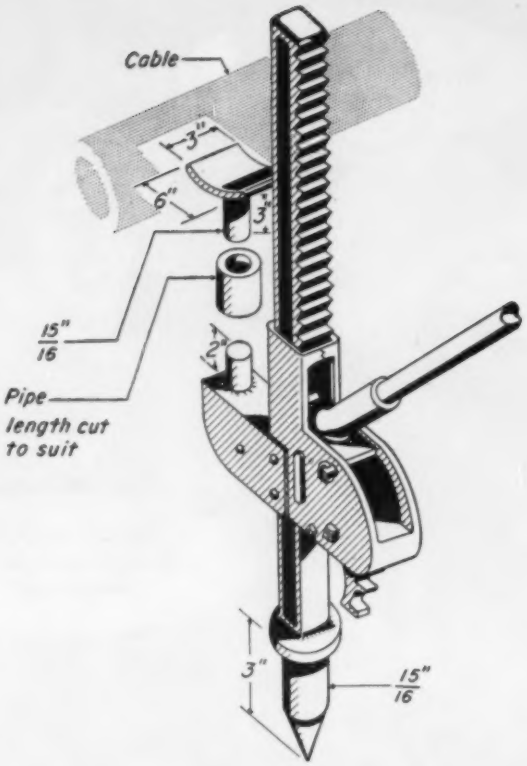
Modified Auto Bumper Jack Bends Heavy Cable

H. C. SQUIRES, East Bay Division, Pacific Gas & Electric Co., Oakland, Calif.

Heavy underground cable may be bent into position with a modified automobile bumper jack. Use of this device permits closer control of the cable bending operation and reduces the chances of personal injury that accompanied the use of old style cable benders or makeshift equipment. The jack also may be used to raise cables when racks or blocks are to be changed.

The bumper jack is modified for cable bending by welding a ½-in. solid steel rod on the end of the horizontal lip of the movable member. A saddle fits over this rod to provide a suitable bearing surface against the cable sheath. The saddle consists of a curved steel piece measuring 3 x 6 in. welded to a length of standard 1-in. pipe. Varying lengths of 1-in. ID pipe are used for saddle extensions.

A piece of ½-in. solid steel rod also is welded to the foot of the stationary member of the jack. This rod is pointed so it will cut into the floor or wall of the manhole to prevent slippage when cable is bent at an angle with the horizontal or vertical. Automobile jacks of other design may be modified in the same general manner.



STANDARD JACK is modified with a steel point on the foot of stationary member to prevent slippage during use

ABOUT $3,200 WAS SAVED by buying a 35-ton flatbed trailer complete and modifying the running gear to fit the frame of a 22-ton flatbed trailer

THREE BOLTS on each side speed the change from one trailer to the other

Running Gear Plus Frames Equals Two Trailers

ROBERT FRANKLIN, Supt of Transportation, Arizona Public Service Co, Phoenix, Ariz.

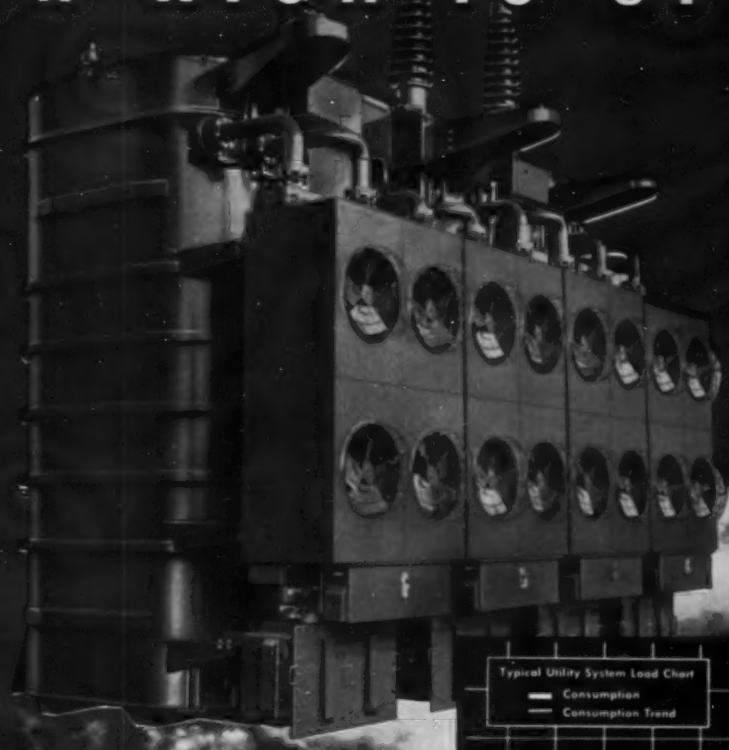
By interchanging an eight-wheel running gear between lowbed and flatbed trailer frames, Arizona Public Service Co has the equivalent of both trailers at a saving of about $3,200. The running gear may be installed easily and quickly on either the 35-ton lowbed or the 22-ton flatbed unit.

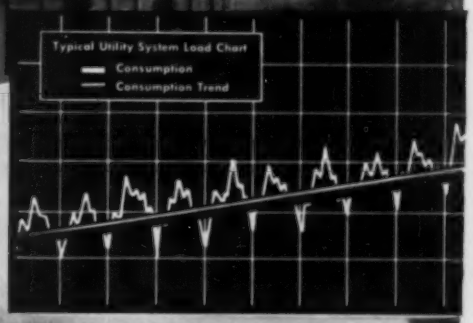
Use of a separate gear was prompted by the occasional need for a low-bed unit to handle large transformers, oil circuit breakers, etc., throughout the far-flung service area of the company. There also was a need for a flatbed trailer to haul general materials, such as poles, about 95% of the time. But an expenditure of $10,800 for both units complete could not be justified.

The problem was solved by buying the flatbed frame and the lowbed unit

(*Continued on page* 88)

HOW HIGH IS UP...





Utility demand charts show that more and more electricity is being used around the clock and around the calendar.

...highest is no place to climb compared to the ...ing demand curves that your utility has to scale daily. The top never stays put, going higher and higher as applications of electricity increase and customer needs multiply.

To serve these systems, Moloney has added new facilities to design and fabricate power transformers of greater Kva ratings to meet your present and future needs.

Moloney can give your system the dependability that operating efficiency requires. Make it Moloney, the "Sign of Quality" all along the line.

MOLONEY ELECTRIC COMPANY

Power Transformers • Distribution Transformers • Step Voltage Regulators • Regulating Transformers • Load Tap Changing Transformers • Load Center Transformers • Unit Substations • Network Transformers • Constant Current Transformers • Capacitors • Transformers For Electronics

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

the features you want

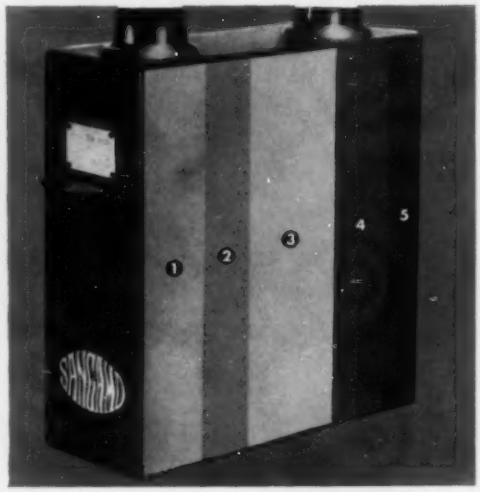
NEW Sangamo

The new Sangamo Power Capacitor combines features which result from efficient design, the use of materials developed by modern chemistry and metallurgy, and exact processing methods — all to assure performance stability.

COMPLETELY CORROSION-PROOFED CASE

Tin-plating of the steel case eliminates rusting during processing, and aluminum metallizing resists corrosive elements in service. Even if the external surface is scratched through to the bare steel the aluminum being anodic to the steel, provides electro-chemical protection. Here are the five steps required to give Sangamo's enduring case finish.

1. Case is tin-plated inside and out.
2. After impregnating and sealing, capacitor is sandblasted, preparatory to aluminizing.
3. Several coats of molten aluminum are sprayed on case.
4. Primer coat of vinyl-base resin paint is applied.
5. Final coat, also of vinyl-base resin paint assures a highly weather-resistant finish.



SOLDER-SEALED BUSHINGS

Bushings are permanently and hermetically bonded to the cover, a bond which is mechanically strong, too. The capacitor can be handled by the bushings without the slightest danger of loosening the seals.

TEMPERATURE STABILIZED IMPREGNANT

Sangamo's stabilized Diaclor will not congeal at the lower temperatures. Hence, Diaclor capacitors can be operated in switched or unswitched banks at temperatures as low as minus 40°C.

TIN-COATED PARALLEL GROOVE CONNECTORS

Copper or aluminum conductors—from #8 solid to #4 stranded — can be used. Tin-plating retards corrosion. Connections can be made without removing terminal nut.

STANDARD MOUNTING

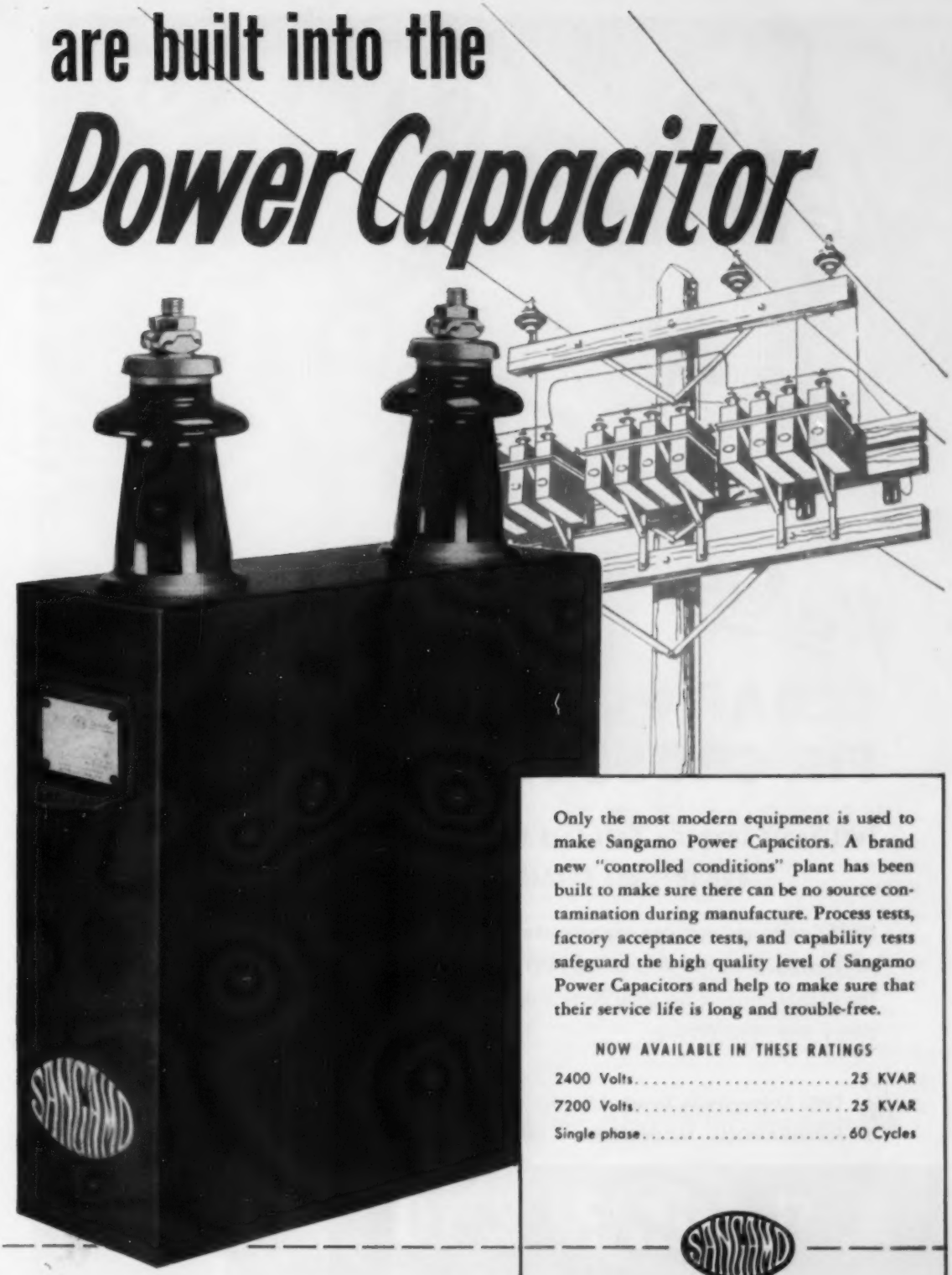
Mounting dimensions have been standardized to enable mounting in NEMA standard hangers. NEMA standard one-unit, two-unit and three or four-unit hangers are available from Sangamo.

If you would like to know more about Sangamo Power Capacitors, write today for your copy of Bulletin 1120 or contact the Sangamo representative in your area.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

are built into the *Power Capacitor*



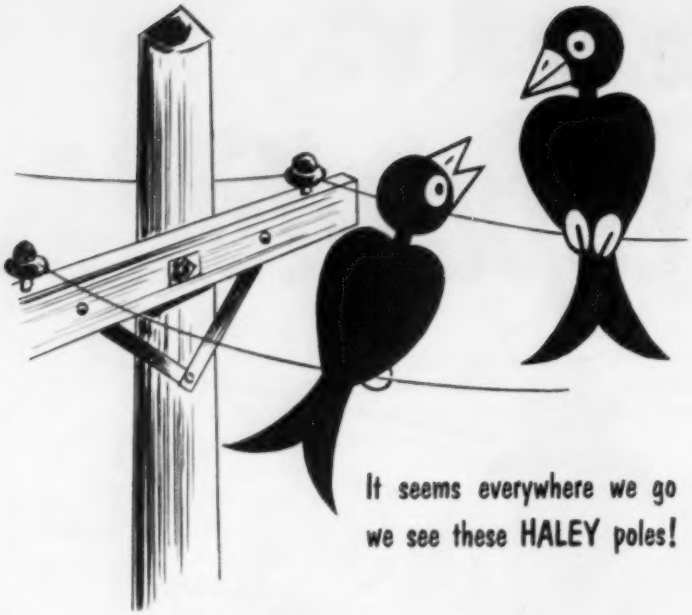
Only the most modern equipment is used to make Sangamo Power Capacitors. A brand new "controlled conditions" plant has been built to make sure there can be no source contamination during manufacture. Process tests, factory acceptance tests, and capability tests safeguard the high quality level of Sangamo Power Capacitors and help to make sure that their service life is long and trouble-free.

NOW AVAILABLE IN THESE RATINGS

2400 Volts	25 KVAR
7200 Volts	25 KVAR
Single phase	60 Cycles

SANGAMO

PC55-2



Haley's PENTAchlorophenol TREATED

CEDAR POLES and FIR CROSS ARMS

Last Years Longer • Cost Less to Maintain and they are CLEAN

HALEY poles and arms are expertly treated with deep-penetrating, powerful, long-lasting PENTAchlorophenol. This CLEAN preservative gives protection from moisture, decay and insect damage.

TWO Strategically Located Yards:
MINNEAPOLIS, MINNESOTA • FINDLAY, OHIO

R. G. HALEY & CO.
SPITZER BLDG. TOLEDO 4, OHIO

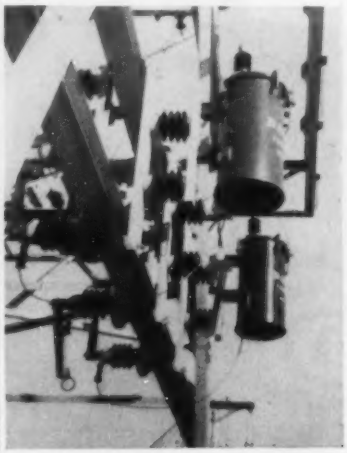
Running Gear

(*Continued from page* 84)

complete, with the running gear designed for the changeover. Both trailers have electrical and air-brake connections permanently installed.

To permit use between both units, the running gear has ¾-in. angle irons welded on its top. These irons attach to the trailer frames with three large bolts on each side. For safety, each bolt is keyed in place. A change from one unit to the other may be made by two men in about 1 hr with the aid of a boom truck and air-operated wrenches. The frame not in use is stored on blocks in the company's central yard in Phoenix.

Although service from this three-piece combination has been satisfactory, area growth soon may dictate the purchase of another running gear to provide two complete trailers.



Distribution Transformers Boost Substation Voltage

MARVIN H. GEBHARDT, System Operations and Planning Engineer, Minnkota Power Cooperative, Inc., Grand Forks, N. D.

Connecting two distribution transformers as boosters in series with the secondary bus at a distribution substation eliminated voltage complaints and saved buying regulators. The remedial action was necessary because the 69-kv voltage level to the substation was lowered to control reactive interchange.

Investigation revealed that the

(*Continued on page* 90)

THE ADVANTAGES OF

ROUND TUBE

BUS CONDUCTORS

The tubular form of bus conductor is rigid in every direction. It has strength as a structural member. It has the lowest impedance to the flow of alternating currents.

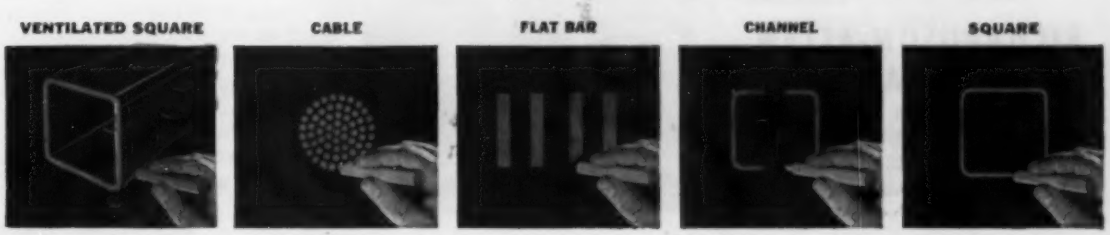
Skin effect is at a minimum in tubes with a high ratio of diameter to wall thickness. At high voltages corona discharge is less than from conductors with edges or sharp corners.

Many engineers prefer pipe sizes standard, extra strong and double extra strong or "Type B" or the "Water Tube" schedules. Other engineers prefer tailor-made combinations of diameter and wall thickness best suited to the specific duty of each installation.

There is a complete line of ANACONDA Copper Bus Conductor designs for every type of installation and power requirement. Write for "ANACONDA Copper Bus Conductors" containing illustrations and detailed technical information. *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.*

55129 Rev.

carry the load with ANACONDA® Bus Conductors



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SELENIUM RECTIFIERS
FOR ABSOLUTELY
Dependable Industrial D-C

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write for descriptive literature

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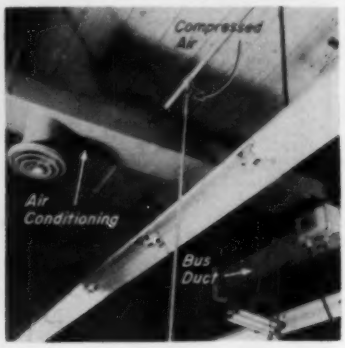
a manufacturing affiliate of
WESLEY BLOCK AND COMPANY
39-15 MAIN ST., FLUSHING, N. Y.
IN CANADA: Richardson-Allen of Canada, Ltd.
370 Victoria St., Toronto, Ont.

Booster Transformer

(*Continued from page* 88)

7.2/12.47-kv secondary voltage at the substation couldn't be raised by adjusting transformer taps. One transformer with two 5% taps above and below rated voltage had a 5% tap available. But the other two transformers with two 2½% taps were already set for maximum voltage.

Because voltage regulation was satisfactory, cost of regulators was not justified. Therefore, to raise the voltage of the low phases, two 7,200–240-v distribution transformers were connected as 3½% boosters in series with the substation bus. Added insulation for the 240-v windings, which were raised to 7.2 kv above ground, was provided by mounting the transformer tanks on insulators.



Meter Shop Uses Plug-In Bus Duct

Three phase, 225-amp capacity, 4-wire, 120/208-v plug-in bus duct is used to supply power at Long Island Lighting Company's new Hicksville meter test shop. Four rows of bus duct are installed near the ceiling, about 9 ft from the floor. This arrangement provides power distribution to all parts of the shop. This arrangement of the present test facilities will not require a rearrangement of the bus duct.

Fluorescent lighting fixtures are located at the same height as the bus ducts. Lumination on the test benches is about 40 foot candles.

Compressed air headers, serving all the test benches, are also located near the ceiling, above the lighting fixtures and bus duct.

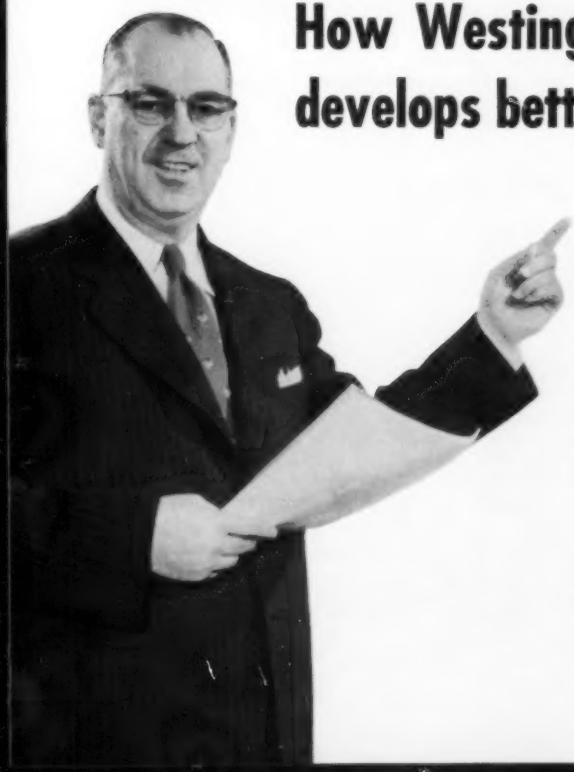
Stow Earth Augers In Draw-out Shelf

R. L. LIENAU, Drum Division, Pacific Gas & Electric Co, Auburn, Calif.

Extra hole-digger auger bits may be carried easily and conveniently on a draw-out shelf under the bed of the hole digger truck. The low position of the shelf reduces the lifting hazard in placing the bits on the truck, saves space on the truck bed, and reduces the possibility of personal injury.

The metal shelf, which measures 24 x 26 in., is supported on a rack that is attached below the truck bed. For safety while the truck is moving, the shelf is automatically locked into the rack by a spring-loaded pin.

A. C. Monteith, Vice President, Engineering, tells you . . .



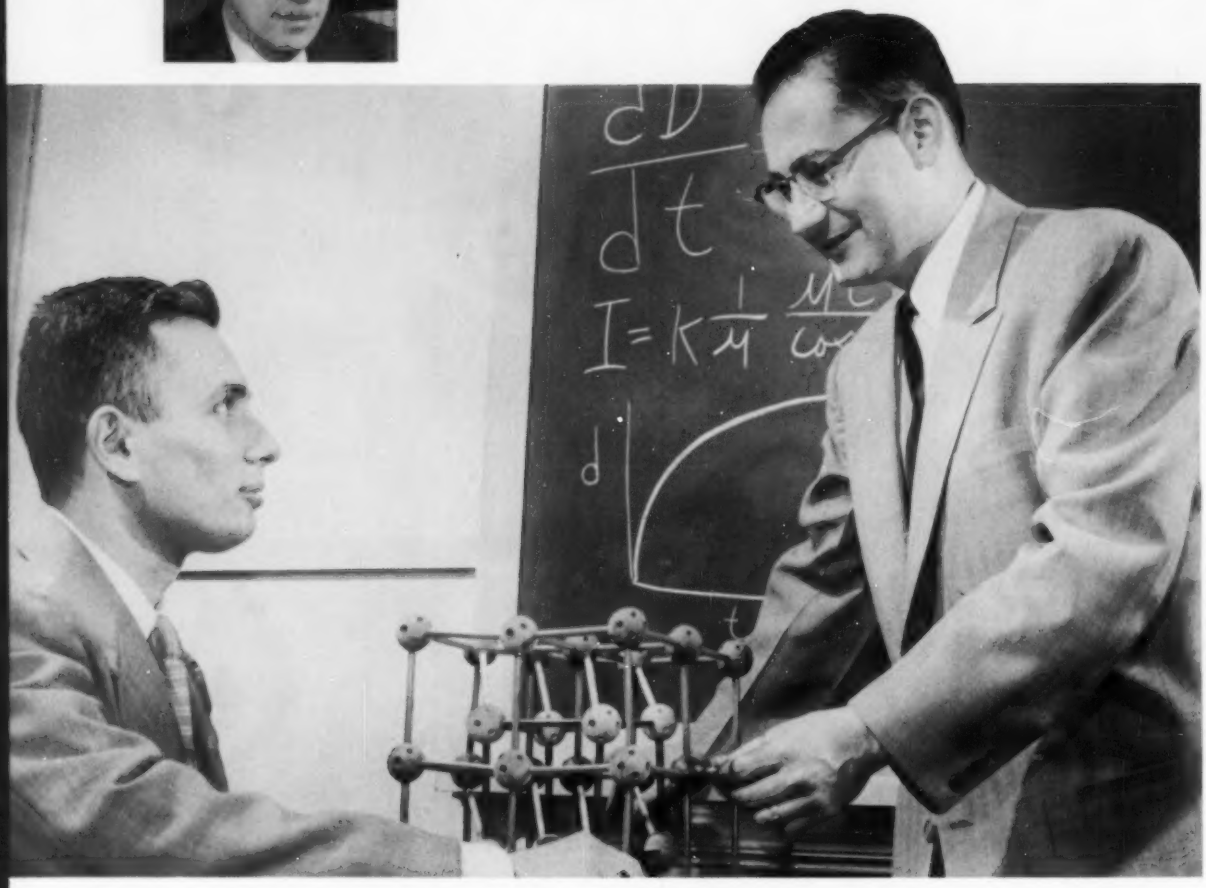
How Westinghouse engineering develops better products, better systems

This team of Westinghouse engineering talent is well known to you. Guiding large staffs of engineers . . . in hundreds of departments and laboratories from end to end of the Westinghouse Electric Corporation . . . they maintain a balance of engineering from fundamental research to the engineering of products and systems.

These outstanding engineering leaders in the electrical industry help you provide more electrical energy to more people at less cost.

The following seven pages will show you how well Westinghouse engineering facilities are matched to your needs for better products, better systems. ——→

Dr. J. A. Hutcheson, *Vice President and Director of Research*



Dr. A. Wexler (right) Manager of Magnetics and Solid State Physics Research. This activity is making significant contributions to new and better apparatus. Here Dr. Wexler discusses grain orientation with Dr. Wiener, one of his staff.

New ideas evolve from new knowledge

Fundamental research at Westinghouse reaches into the void where no knowledge now exists—finding the reasons *why* matter and energy behave as they do. Because these reasons are constantly opening doors to electrical progress, there is no greater facility for service to the electric utility industry.

When it was discovered, for example, that grain-oriented iron magnetizes with less energy, the superior Westinghouse Hipersil® core was developed . . . the most compact and efficient ever devised. From further inquiry into ferromagnetism, entirely new alloys may be created to provide equipment of revolutionary performance.

We now know that elongation of crystal lattices under magnetization sets up the vibration that becomes magnetic noise. The problem: Why do they elongate? Once we have answered that question, it may point a way toward elimination, not just cancellation, of "transformer hum."

Why does insulation insulate? Because we found the answer to that question, one development in solventless resins paved the way to Thermalastic® insulation . . . the insulation which has literally set new standards of apparatus performance.

Westinghouse Research is directing engineering progress along surer, shorter, more predictable paths. It offers you . . . now and in the future . . . equipment that does more and does it better.

L. R. Hill, *Manager of Materials and Equipment Engineering*

New ideas take direction from applied research

In the broad span between fundamental research and the final product, the Materials Engineering Laboratories play the vital role of turning new ideas and materials into practical applications.

The versatile talent here is devoted to probing, exploring, identifying the practical. *Sureness* is designed into an idea before it leaves this department. Some projects are carried to design-sample stage; others, as far as pilot plant production. When thoroughly investigated, projects are turned over to operating divisions for final design and production.

Staffed by mathematicians, as well as engineers, the Materials Engineering Department calculates the probability of success of projects before they are ever begun. This analytical processing of new knowledge provides maximum impetus to discoveries of great promise, and brings you better products, sooner, more economically.

Dr. S. J. Angello, Manager, Semiconductor Engineering, exhibits a new semiconductor in which impurities have been reduced to one part in ten billion—an outstanding metallurgical accomplishment that may accelerate progress on lightning arresters and other apparatus.

"Assistant brain" in Materials Engineering is the digital computer used in calculating probability of success of experimental projects, and in fast, precise analysis of data.

The Magamp* regulator and excitation system was developed by Materials Engineering to provide reliable regulation for synchronous machines. This is the Magamp pilot plant.

**Trade-Mark*

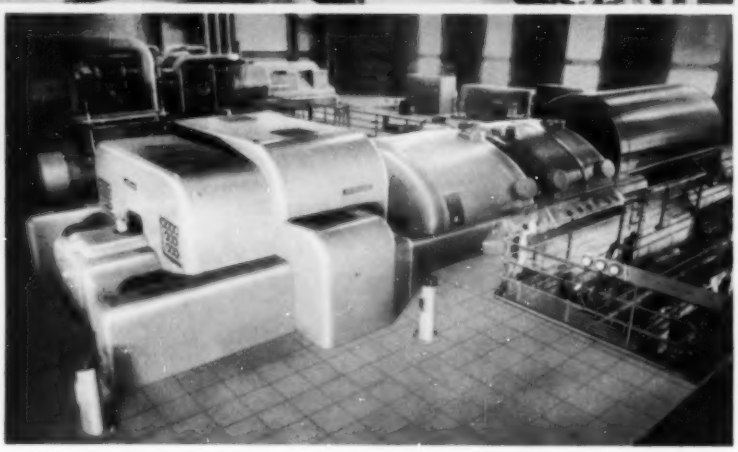
YOU CAN BE **SURE**...IF IT'S Westinghouse

New ideas become new products through design and manufacturing engineering

Whether the project is a new product, or an improved product, it is in Design Engineering that final physical form is decided, and in Manufacturing Engineering that it is achieved. Here, new alloys become turbine blades; an insulation development becomes Thermalastic insulation for generators. Here, products are designed that not only meet Westinghouse standards of reliability, but that are practical to produce, competitively priced, and suited to your requirements.

Ever-increasing demand for higher equipment capacity and lower cost per kilowatt will be met by

Design Engineering Departments, such as this, throughout the many divisions of the company are centers of creative engineering, providing continuing progress in products for the industry.



This modern tandem-compound, turbine-generator unit is one of the largest 3600-rpm, single-shaft machines in service. Already new achievements have raised sights to 275,000 kw and beyond . . . at supercritical pressures and at considerably higher temperatures.

YOU CAN BE **SURE**...IF IT'S

the new Westinghouse supercritical-pressure turbine-generator. This record breaking unit will be designed for 5000 psi, 1200° F. Even at 5000 psi, 1150° F—at which it will operate initially—station heat rate will be much better than the most efficient station existing today.

Generator inner-cooling is another great engineering development of Westinghouse—making possible turbine-generators of 275,000 kw and larger, on a single shaft. To dissipate heat more effectively than ever before, hydrogen is literally blown inside both rotor and stator conductors.

Thermalastic insulation, in addition to providing never-before-achieved performance for turbine-generators, is now being applied with outstanding success to virtually all types of heavy rotating electrical apparatus offered to utilities.

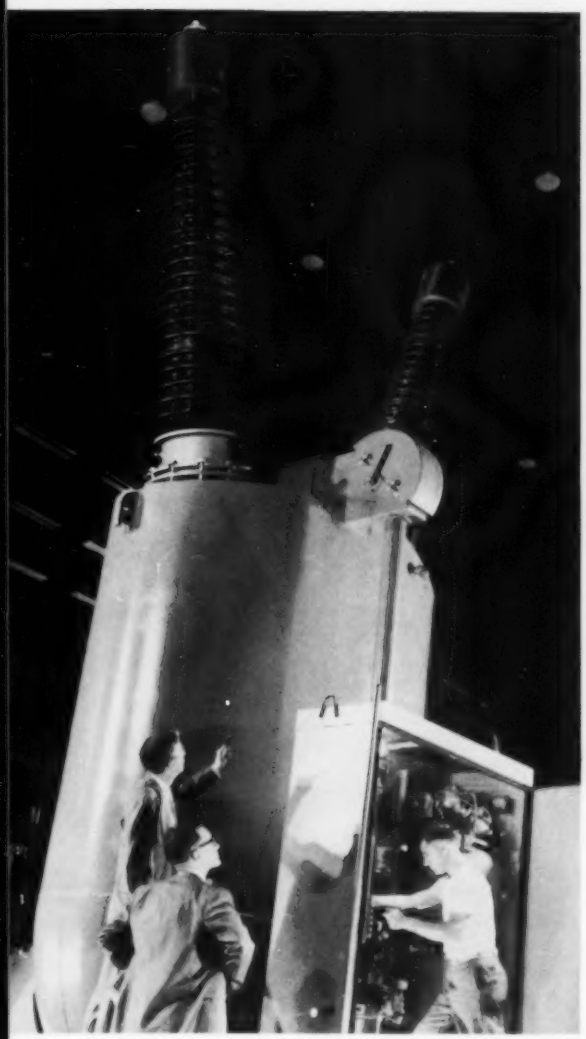
Advancements like these are sweeping aside the limits of turbine-generator capacity, and are establishing new criteria of efficiency and performance.

Let's consider, too, the power circuit breaker. Under guidance of Westinghouse creative engineering it has grown to the modern giant, "Big Ben," capable of interrupting 25,000,000 kva at 330 kv.

With the introduction of the multiflow grid, in 1941, Westinghouse provided the industry high breaker capacity in substantially smaller tank sizes, and cut arcing time from eight to three cycles. And, in 1950, Westinghouse brought out the Watchcase* breaker design, reducing oil requirements 50%.

Today, with an ever-growing investment in design leadership, Westinghouse effectively enables you to transmit larger and larger blocks of power in a manner that is both practical and profitable.

**Trade-Mark*



H. N. Muller, *Assistant to the Vice President, Engineering*
Dr. J. A. Hutcheson, *Vice President and Director of Research*
D. E. Inman, *Engineering Manager, General Products Divisions*
D. C. Burnham, *Vice President, Manufacturing*
J. C. Fink, *Engineering Manager, Apparatus Products Divisions*
R. C. Bergvall, *Engineering Manager, Defense Products Divisions*

Watchcase circuit-breaker tank design reduced oil content from 20,000 to 9600 gallons . . . another great power breaker advancement by Westinghouse engineering.

Westinghouse

Over 200 laboratories are the workshops of Westinghouse engineers

Advanced research and development on steam and gas turbine equipment is conducted at the new Westinghouse Laboratory near Philadelphia. Here, 100 engineers and technicians work with the world's most modern facilities. Out of this laboratory will come the great developments of the future, helping the utility industry produce kilowatts at the lowest possible cost.

The Westinghouse High Power Laboratory at East Pittsburgh, Pa., is truly a design tool. Accompanying product development each step of the way, this huge facility is a proving ground for testing apparatus under actual fault conditions, before it is produced commercially . . . before it is offered to you.

The new Research Center just outside of Pittsburgh will house the finest facility of its kind in the industry.

YOU CAN BE **SURE**... IF IT'S Westinghouse

J. E. Barkle, *Manager, Electric Utility Engineering*
M. B. Wyman, *Manager, Engineering and Service*
Dr. E. L. Harder, *Director, Analytical Section*

Engineering teams tailored to your needs

Here is Operation Interchange—Westinghouse Engineering and Service Department—where problems and needs of the industry are interpreted in terms of new products, applications and system ideas. This huge, closely knit organization of engineers and analytical facilities brings the best possible combination of engineering and service to bear on electric utility problems.

The focal point is the well-known Electric Utility Engineering Group at East Pittsburgh. The clearinghouse for all our utility engineering activities, it applies broad knowledge of the entire industry to your individual problems.

Westinghouse Consulting and Application Engineers in the field assist you with on-the-spot problems. They are equipped with a wealth of product application and system information, continually augmented by the Utility Engineering Department.

Westinghouse Service Engineers are located throughout the country to aid you in installation and operation of new apparatus and in servicing, inspecting, maintaining.

The finest analytical and computing facilities available back these engineers in their solutions of your problems. Outstanding examples are the digital and analog computers, and the a-c network calculator.

Your engineers will have valued assistance in Westinghouse specialized experience, and extensive laboratory and analytical facilities.

World's largest network calculator makes possible the solution of problems heretofore impossible.

This engineering team serves you through *The Man With The Facts* . . . your Westinghouse sales engineer

Better equipment, better methods, better systems . . . and any Westinghouse service that will help you achieve them . . . that is what the Westinghouse sales engineer is selling. Through him, your problems or requests will open doors throughout the company, from research to installation service. Your Westinghouse sales engineer is *The Man With The Facts*—to help you convert needs into facilities, to help you market more power, more efficiently, more economically.

Call THE MAN WITH THE FACTS . . . or write direct to Westinghouse Electric Corporation, 3 Gateway Center, Pittsburgh 30, Pa.

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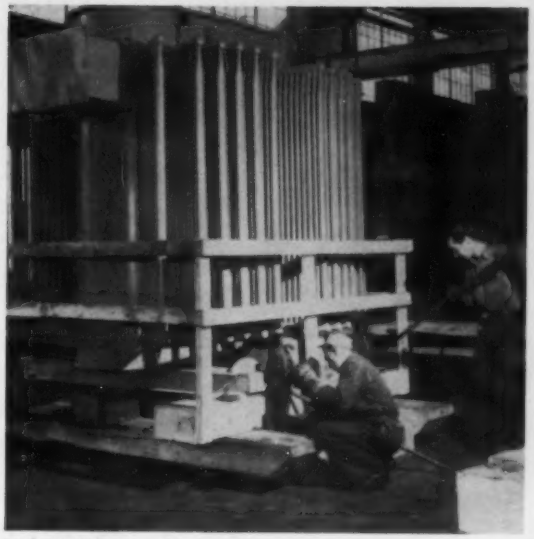
Westinghouse

CP-1027

INDUSTRIAL APPLICATIONS

Aerial Substation Serves Packed Plant



Big 3,000-kva transformer . . .

Hemmed in on their land and cramped for floor space, many companies face critical expansion problems. Among them: Where to put new substations? If you can't spread out there's but one other choice. Go up . . .

The Hastings Mill of Anaconda Wire & Cable Co has met increased demands for electric power in its cramped-for-space plant by having its engineers design an overhead, out-of-the-way steel platform to hold a unit substation.

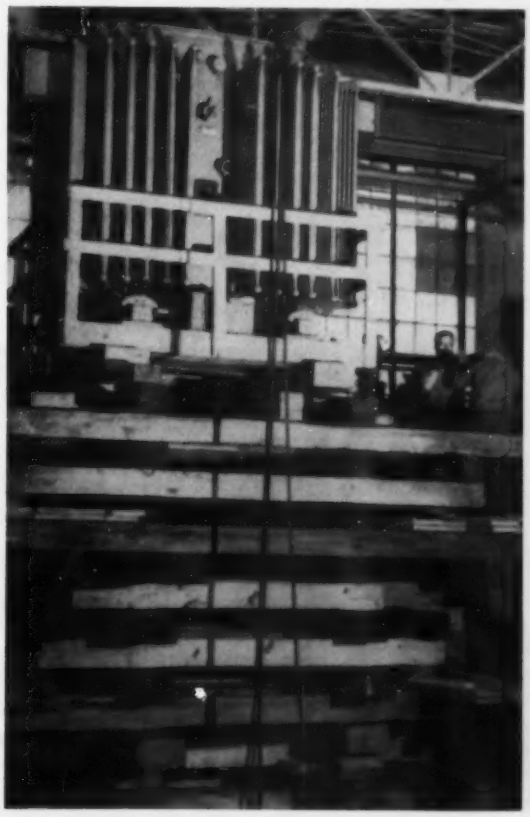
This enabled the company to take advantage of space normally wasted. At the same time, it solved an incipient power-shortage problem arising with an expanded wire-drawing and rubber-covering program.

The elevated platform was built of steel plate on I-beams. It is 16 ft wide and 30 ft long. It was raised 12 ft above the floor because it bridges an entryway used by fork-lift trucks. The high platform also enables employees to handle over-sized cable reels easily beneath it.

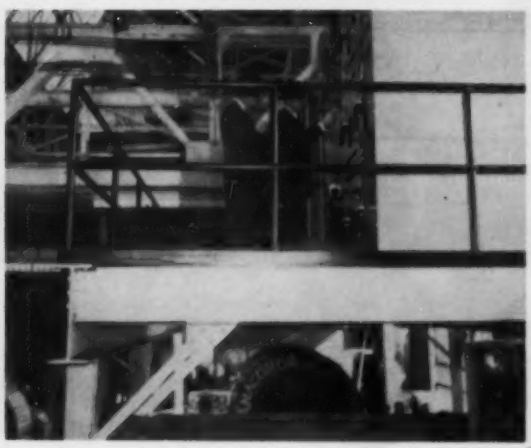
The loaded platform now holds 25 tons of equipment, including a 34,700-lb, 3,000-kva transformer and associated switchgear. The transformer steps down the incoming 13,800 v to the level of the plant's 600-v, three-phase, three-wire distribution system.

Men jacked the transformer up to its site on a wooden platform made of 8x10 and 6x8 timbers. Four jacks, each with a 15-ton capacity, were used at the wooden platform's corners. As a precaution, the men put 12x12 timbers under the edge of the metal platform to absorb the unbalanced load while the transformer was being rolled into place.

. . . is jacked 12 ft high . . .

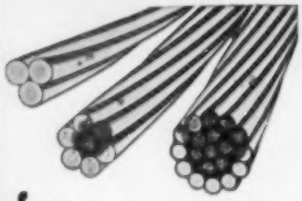


. . . to overhead substation



ACCO Quality

PAGE Stainless Steel Strand



for Severe Service Conditions

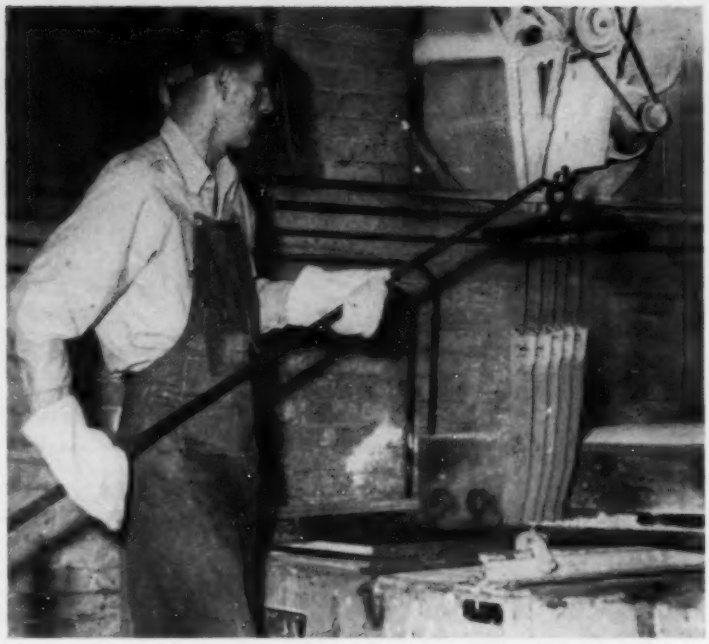
PAGE Stainless Steel Strand is equally versatile for ground, guy and catenary applications. Its higher tensile strength, corrosion-and-abrasion resistance, elastic limit and strength-to-weight ratio make it your first choice! Its lower cost per year of use means long-range economy.

Write us at Monessen, Pa., for complete information

ACCO Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Bridgeport, Conn.

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

for Better Value



Electric Heat-Treating Ups Blade Output

D. E. DOME, Commercial Industrial Dept, Ohio Power Co, Newark, Ohio

New electric heat-treating facilities have raised the quality and production rate of blades manufactured for rotary lawn mowers by Newark Stove Co, Newark, Ohio.

The equipment consists of an 80-kw salt bath furnace containing 1,550 lb of salt, a separating tank containing 20 kw of immersion heaters, and a 40-kw quenching tank. Correctly heat-treated blades are produced at the rate of 172 an hour.

The operator handles 20 blades at a time in a complete treatment cycle that lasts 6 min. Heat treatment temperatures of 1,600F and quenching temperatures of 530F are obtained. The same equipment can turn out 5,040 heat-treated washers a day for mower assembly.

New Twists in Pretzel Production

L. ALBERTSON, Application Engineer, Philadelphia Electric Co, Philadelphia, Pa.

Production efficiency has been helped in the pretzel bakery of J. Reisman & Sons, Inc, Philadelphia, Pa., by a 2.5-kw automatic electric water heater and electric fans. The stone-steel-lined 80-gal heater supplies a constant supply of rust-free water at a uniform temperature for mixing dough. The water heater is in tandem with a purifier. Small fans, attached to each pretzel twisting machine, blow a stream of air on the dough as it leaves the machine. This eliminates stickiness and insures a continuous flow of formed pretzels to the conveyor belt.

PRETZEL-MAKING is expedited by small fans (circled) on production machines

(Industrial Briefs on page 104)

ALLIS-CHALMERS
NETWORK
TRANSFORMERS

Compact, low-loss design. Thermal capacities are high for severe load conditions. Sturdy, time-proven core and coil construction withstands repeated short-circuit stresses of network operation.

Safe, dependable tap-changing mechanism. Handle inserted through two-inch opening on cover operates mechanism. Handle cannot be removed unless it is in positive tap position. Cover location of handle entrance eliminates packing gland maintenance.

Threaded valve connections to tank are solder-wiped for extra protection. Valves are located for easy access. Globe-type valves with non-rotating seats close tight, avoid wear on valve seats.

Spiral-wound gaskets have proved their superiority over other types of gaskets for sealing bushings in the tank wall in over 6 years' continual use. Alternate plies of preformed springlike metal and non-metallic fillers provide unusual resilience and actually adjust themselves to changes in operating conditions. Gaskets can be installed without cements or grease. They can be quickly removed if required and may be re-used if necessary.

Shot blast cleaning, three coats of baked-on paint formulated for high water resistance, and compound treatment of base and tubes in base area give superior surface treatment. A-4317

in City after City...

PROVED

By Performance

On utility systems all over the country Allis-Chalmers network transformers meet the test of reliable and economical service. New A-C network units are ordered repeatedly to take their place alongside the more than 1¼ million kva already installed.

You get unusual flexibility in choice. To simplify your application problems, Allis-Chalmers builds all three basic types: oil-filled, *Chlorextol* liquid-filled, and sealed dry type.

It will pay you to investigate the design and construction details of Allis-Chalmers network transformers before you order your next unit. Consult the A-C district office near you or write Allis-Chalmers, Milwaukee 1, Wisconsin, for more information.

Chlorextol is an Allis-Chalmers trademark.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

G&W Primary SERVICE ENTRANCE

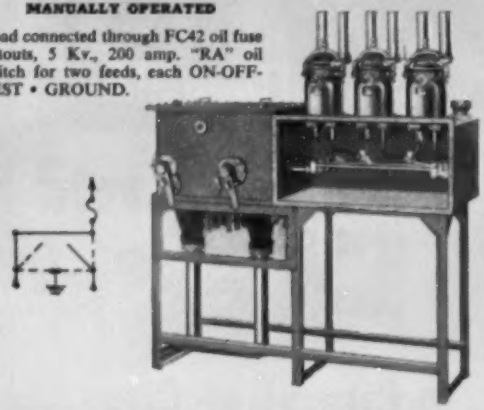
Provide Load Break Disconnection and Short Circuit Protection

COMBINATION FUSE-SWITCH UNITS—Type "FC" oil fuse cutouts or "SC" power fuses (for isolating abnormal loads) combined with load break oil switches (for selecting or isolating feed circuits). The "RA" oil switches may be single or double throw, manually or automatically operated.

"RA" OIL SWITCHES WITH "FC" OIL FUSE CUTOUTS. (Water-tight units)

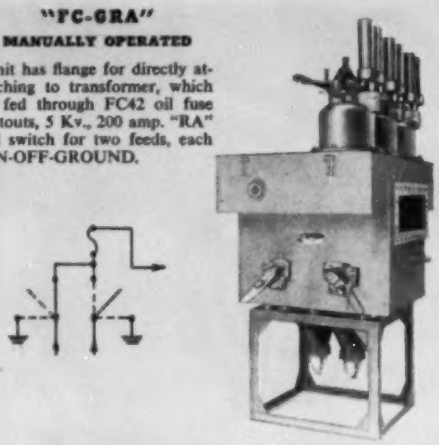
"FC-GRA"
MANUALLY OPERATED

Load connected through FC42 oil fuse cutouts, 5 Kv., 200 amp. "RA" oil switch for two feeds, each ON-OFF-TEST • GROUND.



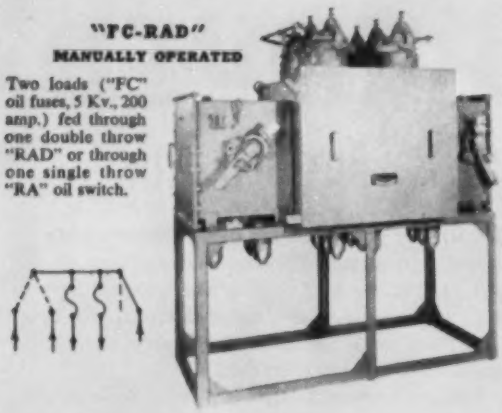
"FC-GRA"
MANUALLY OPERATED

Unit has flange for directly attaching to transformer, which is fed through FC42 oil fuse cutouts, 5 Kv., 200 amp. "RA" oil switch for two feeds, each ON-OFF-GROUND.



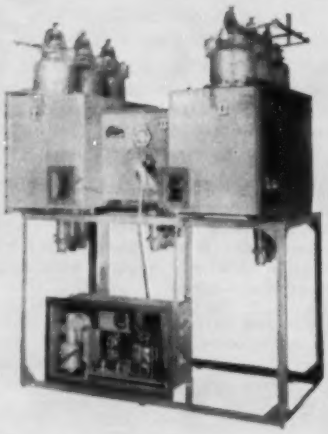
"FC-RAD"
MANUALLY OPERATED

Two loads ("FC" oil fuses, 5 Kv., 200 amp.) fed through one double throw "RAD" or through one single throw "RA" oil switch.



"FC-RAD-F"
AUTOMATICALLY OPERATED

Double throw "RAD" oil switch, 15 Kv., 400 amp. with model "F" automatic transfer mechanism. Each feeder connected through FC62 oil fuse cutouts (13.2 Kv. solidly grounded neutral, 200 amp.)



LINK POSITION VIEWING WINDOWS in "RA" oil switches permit "seeing" that the circuit is open or grounded before working on the cable. Tested LOAD BREAK and full level electrical characteristics insure SAFETY to operating men.

Send for series "C" and "D" bulletins.

ENGINEERING REPRESENTATIVES IN MANY CITIES OF NORTH AND SOUTH AMERICA

In Canada—Powerlite Devices, Ltd. **Toronto, Montreal and Vancouver**

50th ANNIVERSARY G&W 1905-1955

Load Break SWITCH AND FUSE UNITS

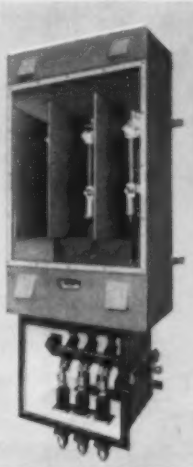
Save Space, Installation Labor and Equipment Cost

The advantages of G&W oil fuses and oil switches for primary cable service entrances have been proved by over 20 years of satisfactory operation by many electric utilities:
LOAD BREAK—SMALL SPACE—MINIMUM MAINTENANCE—LOW COST—VERSATILE FORMS.

"RA" OIL SWITCHES WITH "SC" POWER FUSES.

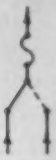
"SC-RAD"
MANUALLY OPERATED

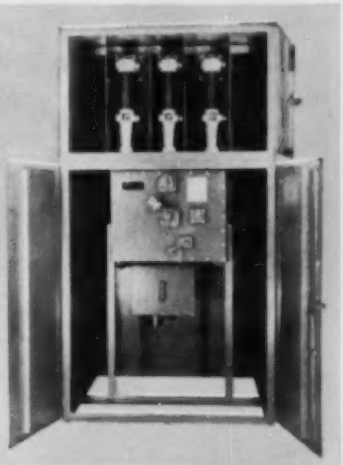
Two feeds through "RAD" double throw oil switch, 15 Kv., 400 amp. load break. "SC" power fuses with load outlet at top.



"SC-RDA"
AUTOMATIC THROWOVER MANUAL THROWBACK

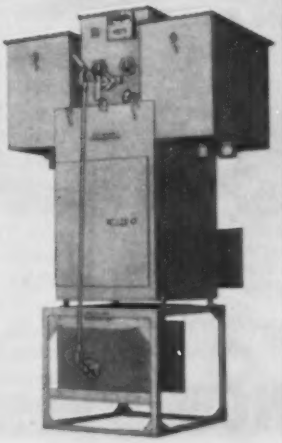
"RDA" double throw oil switch 7.5 Kv., 400 amp. load break. Model "A" automatic throwover mechanism. "SC" power fuses 5 Kv. All enclosed in cubicle having hinged doors and keylocks.





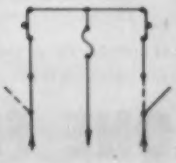
"SC-RAD-F"
AUTOMATIC TRANSFER

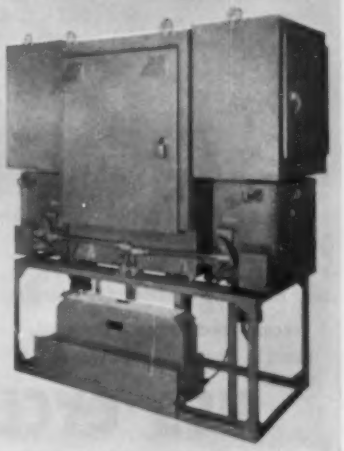
Two feed circuits, each loops through boxes on each side at top. "RAD" double throw oil switch, 15 Kv., 400 amp. load break with Model "F", automatic transfer mechanism. "SC" power fuses in middle cabinet with throat in back for direct attachment to transformer.



"SC-DRA-E"
AUTOMATIC TRANSFER

Two single throw "RA" oil switches, 15 Kv., 400 amp. load break. Isolating links between oil switches and "SC" power fuses. Model "E" automatic transfer mechanism.





G&W combination fuse-switch units are functionally designed for compactness and minimum cost. When required, they can be enclosed in rectangular cubicles to match other equipment. (See upper right hand illustration)

Send an outline of your problem for our recommendations.

MAIN OFFICE AND FACTORY **G & W ELECTRIC SPECIALTY CO.**

7780 Dante Avenue **Chicago 19, Ill., U.S.A.**

CD552

"They're wasting money—a Cyclone Fence and a watchman!"

YOUR LOCAL BURGLAR can vouch for the fact that Cyclone Fence—*all by itself*—will keep intruders away from your property. That's just one reason why Cyclone is the most widely used property protection fence in the entire world.

You *can* buy cheaper fence than Cyclone, but it will cost more in the long run. Cyclone contains nothing but brand-new, top-quality material. The chain link fabric is woven from heavy steel wire—galvanized *after* weaving to prevent cracks that encourage rust. Erection is handled by full-time, well-trained experts, so you can be sure of a fence that stays taut and trim.

Cyclone engineers will be glad to help you solve your fencing problems. Meanwhile, *send for the free booklet.*

CYCLONE FENCE DEPT., AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL CORPORATION

WAUKEGAN, ILLINOIS · SALES OFFICES COAST-TO-COAST · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS CYCLONE FENCE

Cyclone is the trade-mark name of fence made only by Cyclone. Accept no substitute.

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Our informative booklet is filled with photographs, drawings and graphic descriptions of different styles of fence and gates for the protection of property. Whether you're interested in a few feet of fence or miles of it, you'll find this booklet worth your while. Send for your copy. It's free.

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USS

UNITED STATES STEEL

INDUSTRIAL BRIEFS

Warming a watchman with a 4-kw electric unit heater saved Alton Boxmakers, Inc of Pacific Mo., the expense of extending a steam line to the 12 x 14 x 8 outpost. The electric unit does an adequate job. Robert E. Enkelmann, Industrial Engineer, Union Electric Co of Missouri, St. Louis.

Heating paint with a small 2-kw electric immersion heater, costing only 32 cents a day to operate, is saving Calig Steel Drum Co more than $11 a day in paint thinner. The warm paint now requires no thinner (costing a minimum of 45 cents a gal) before being sprayed on the company's steel-drum products. Paint temperature is thermostatically controlled to 140-150F. Savings during the first month's operation almost defrayed the entire original investment. The warm paint yielded finished surfaces of a much higher quality, which was the main objective. Jack R. Taylor, Industrial Salesman, Duquesne Light Co, Pittsburgh, Pa.

Heat-treating metal with flexibility is one of the important characteristics of a 375-kv unit in the commercial heat-treating shop of the Paulo Products Co, St. Louis. The high frequency current is provided by electronic tubes. The shop handles a wide variety of work from those industries who send their work out because of the small volume of heat-treating work they have. The Paulo Products Co unit handles surface heating, brazing and soldering operations for a number of different customers. Charles T. Heaton, Industrial Sales Representative, Union Electric Co of Missouri.

SEND IN YOUR INDUSTRIAL BRIEF

You'll get more satisfaction from knowing your item helped someone else than from the $5 you will be paid for each item accepted. Give us the basic facts covering the application; the name and location of user; benefits, advantages, and load characteristics of the application. Mail to: Industrial Briefs Editor, Electrical World, 330 W. 42 St., New York 36.

25 KVA
distribution transformer

5000 KVA, 3-phase
oil-immersed power transformer

★ Important reason why every CENTRAL TRANSFORMER is of consistent high quality . . . why longer life, uninterrupted performance is assured

Each detail in the manufacture of Central transformers is checked and double-checked against rigid specifications. Not until the chief inspector's final OK is stamped on the tag, is a Central transformer ready for delivery.

It is this exacting inspection, plus careful engineering, finest materials, skilled workers and a modern plant that has won for Central a reputation for the design and manufacture of transformers unexcelled anywhere.

No wonder more and more firms are looking to Central for precision-built transformers. Why don't you discover how Central can serve you?

A type for every need . . . from the smallest to the largest

CTC NEMA **Central** TRANSFORMER CORP.

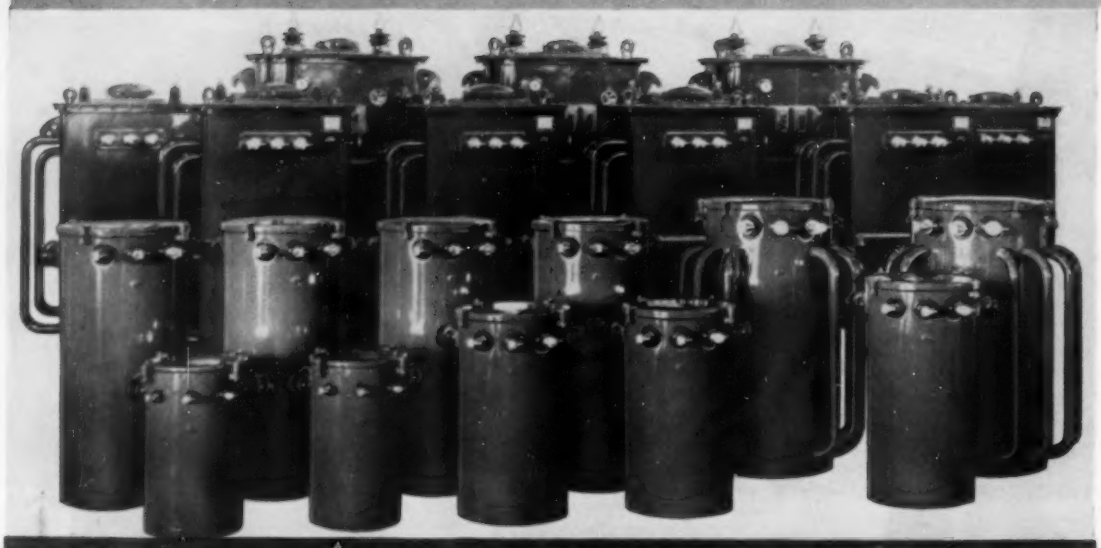
PINE BLUFF, ARKANSAS
Sales Offices in principal cities.

DESIGNERS AND MANUFACTURERS OF TRANSFORMERS ONLY

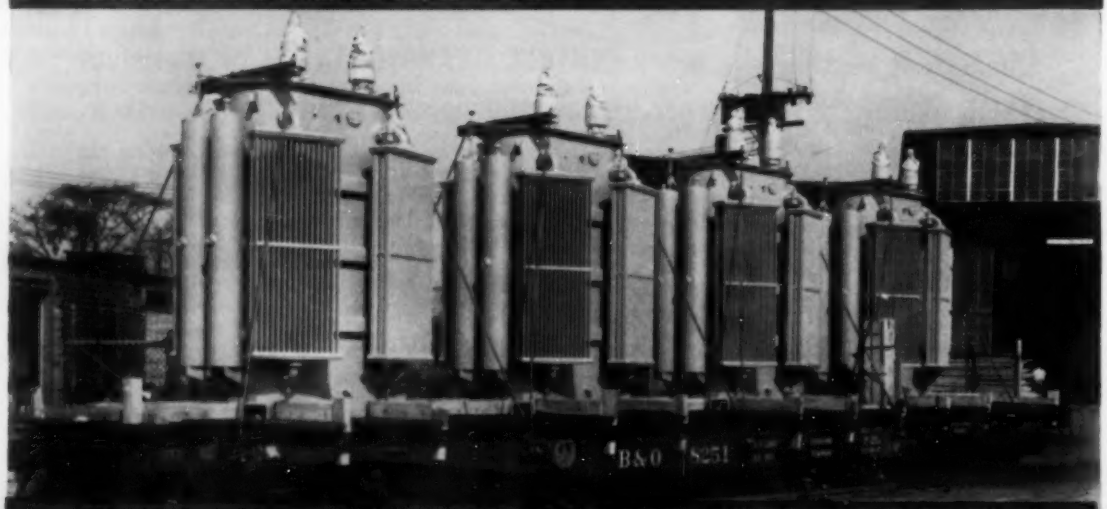
wherever there's power

Standard®

DESIGN FEATURES



IN MANILA . . . This shipment of 2400-volt, single-phase transformers will see service at a hospital. The group includes three 333 KVA units and six 167 KVA units which are Askarel filled. Oil-filled units are 3, 15, 25, 37½, and 75 KVA. Standard transformers are in service throughout the world.



IN LOS ANGELES . . . This group of 2500 KVA, single-phase, OISC transformers—34,500 volts primary and 2400 x 4800 volts secondary—was produced by Standard to meet the customer's specifications. Standard can build to your requirements and incorporate any special components you designate.

Transformer's

HELP CUT COSTS

● Standard Transformer's attention to transformer components helps cut maintenance costs and boosts transformer life, yet you pay no more for Standard equipment.

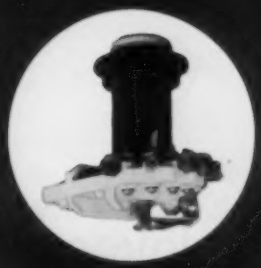
Insulation exceeds all ASA specifications and gives increased protection against flashover. Coils are moisture-proof.

Power-sheared laminations minimize short circuits and core loss caused by burrs. Simple construction eliminates expensive and unnecessary clamps and parts in core assemblies. Greater coil surfaces practically double radiated heat.

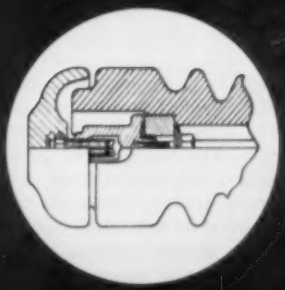
NEMA size connectors, strain tested by mercurous nitrate, are used on all bushings. Installation and maintenance time and costs are reduced.

Standard engineers will incorporate components of your choosing in your transformers and work with you to design the transformers best suited to your needs.

UNIFORM SEAL—This Standard design feature creates a four-point contact that assures a positive seal completely around the transformer cover. A Neoprene gasket seals out all dust and moisture.



TAP CHANGER—Your transformers can be equipped with four taps above or below, or half above and half below, as you specify. The switch embodies a contact-making assembly with a spring-loaded brass wheel for positive contact. Normal settings are with a four-tap voltage section. 2½% taps within 10% range of normal rating.



TANK WALL BUSHING—Permits line insertion without tools. No exposed live parts. Terminal compression stud keeps insulated plastic cap from falling off when unscrewed to receive primary leads. Cables enter from either side. Pressure from clamping shoe holds lead securely.

WRITE for your new Standard Single-Phase Transformer Bulletin S-401-B. It's ready now!

Standard®

THE STANDARD TRANSFORMER COMPANY

WARREN, OHIO

REPRESENTATIVES IN PRINCIPAL CITIES

Dealer smiles approval as utility employee signs up for washer and dryer at a reduced price in one region where . . .

Employee "Special" Purchase Plans Work

Idaho Power finds that they speed customer acceptance of new appliances for dealers and distributors, build load and good will for the company

A. S. GILBERT, Sales Manager, Idaho Power Co, Boise, Ida.

"Special" appliance prices to utility employees—thorn in the side to many a utility-dealer relationship—are proving to be a real asset in the Idaho Power Co territory. Dealers and distributors, both, for the most part are giving the practice their entire support.

The key to this success: a cooperative promotional program between the power company and the other two parties. The result: Better employee relations and bigger loads for the company; speeded customer acceptance of new appliances and added sales for dealers and distributors.

For the past seven years, Idaho Power employees have been offered appliances at good savings through a regular purchase plan and "employee specials." By urging them to show and demonstrate their new purchases to friends, the company has found the practice, if anything, has served to stimulate general retail buying. Few, if any, dealer complaints have been forthcoming in the areas where the plan is thoroughly understood.

"Employee specials" are offered on all types of major and table appliances new to the field or that need special promotion. Dealers run ads at the same time a special is offered. Purchase prices are reduced to a point where there is little or no margin for either distributor or utility. But widespread use of the appliance more often than not follows. During the past seven years, 46 specials have been offered, all with profitable results. Featured have been eight different major appliances and ten smaller types. While some have stimulated retail sales more than others, each special has produced good solid dealer profits and load increases.

Specials That Worked

One of the most successful so far is the fall electric bedding special which draws particularly heavy promotional cooperation from distributors and dealers. Reports have shown consistant increases in sales as an aftermath of the event. Now, by continuing these methods, Idaho Power hopes by 1958 to have 100,000 blankets on its lines (it serves 103,086 residential and farm customers).

Automatic washers and dryers are another case in point. Employees purchase laundry equipment worth $500 for about $300. One Idaho distributor who leads the nation percentagewise in sales of the two units, attributes his position in part to sales prompted by the specials.

Still another special that clicked: the introduction of the deep-fat fryer into the area in 1950. It helped sell 360 fryers in the Idaho Power area then, and has been repeated twice with about the same results.

In addition to the periodic specials is the continually-running employee purchase plan. Regular full-time employees may buy appliances at list price less 30% or at company cost plus 10%, whichever is higher. Purchases are restricted to appliances bought for their own use or as gifts for members of their immediate families. If need be, the company will finance the purchase on time, less a 15% down payment at carrying charges one-half the usual rate.

(*More S & S on page* 112)

Many times worse than lightning!

To make sure O-B Pintypes stand up in low-voltage distribution systems, we tested some with *triple* the attack they'd be likely to meet in lightning exposure. Rate-of-voltage-rise is the characteristic of lightning that causes insulator damage. Natural lightning rate-of-rise normally falls in the range between 2000 to 5000 kv per microsecond. At the O-B laboratory we've smacked pintype production samples with steep-wave impulses *three times more steep!* And, as wave front rate-of-rise increases, its destructiveness is magnified at a vastly greater rate. The O-B Pintype shown here has sustained 14 shots of a wave front exceeding 14000 kv per microsecond. Its glaze is a bit scuffed up, but the unit is perfectly sound!

Statistically, lightning strikes a line once per mile per year in ordinary sections of the United States. You can figure on getting hit—hard—but you can also figure on sustaining the hits year after year if you insulate with O-B Pintypes!

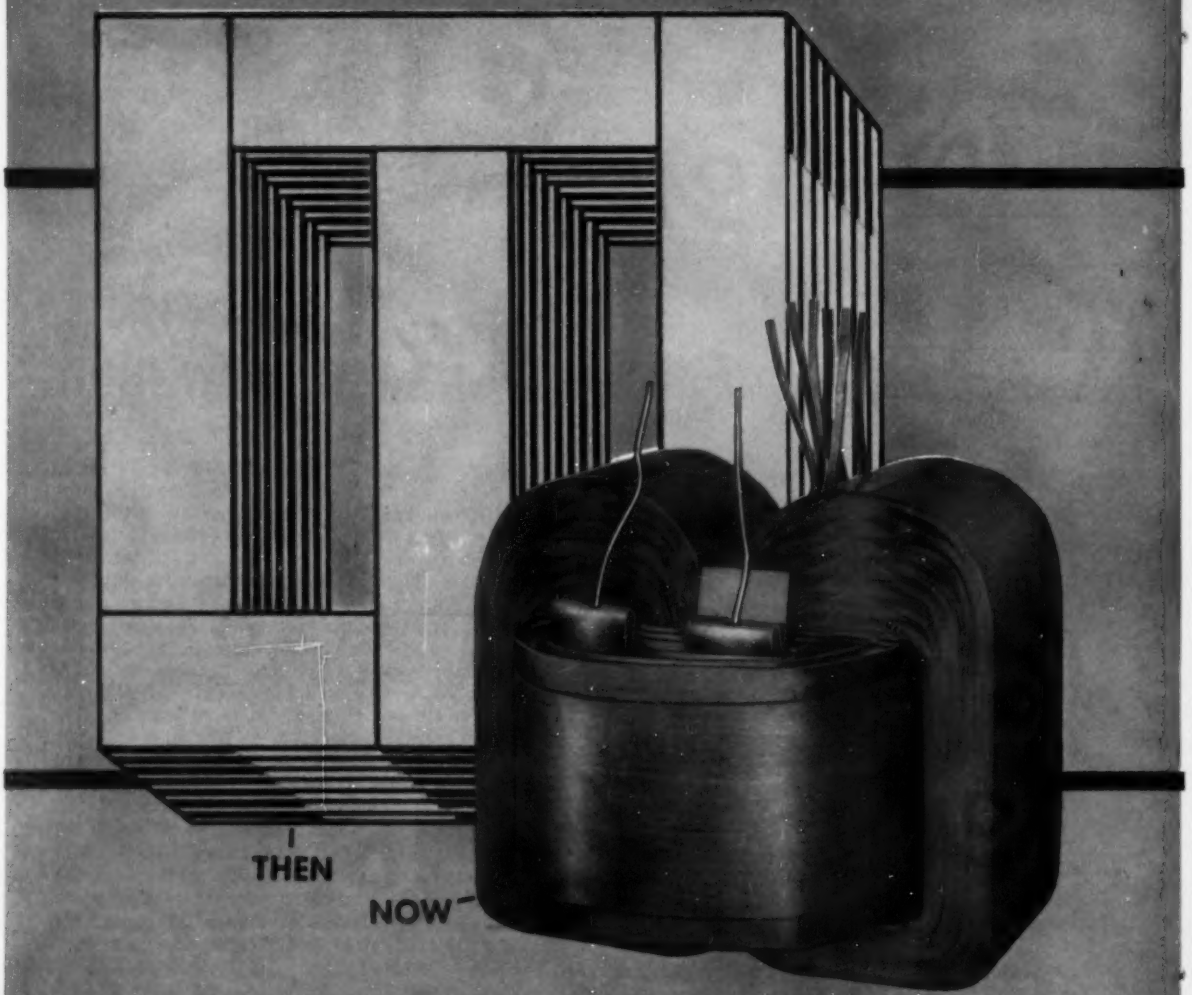
OHIO BRASS COMPANY • MANSFIELD, OHIO

4541-H

Ohio Brass

the KUHLMAN BENT IRON CORE...

THE SMALLER, THE LIGHTER, THE REVOLUTIONARY CORE



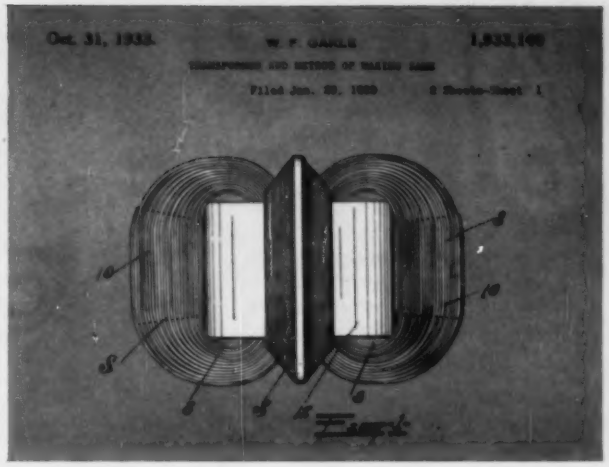
KUHLMAN

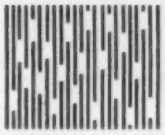
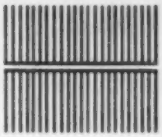
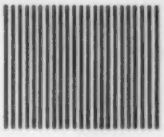
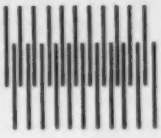
KUHLMAN ELECTRIC COMPANY
BAY CITY, MICHIGAN, CRYSTAL SPRINGS, MISSISSIPPI, SALINAS, CALIFORNIA

"an industry first"

Patent #1,933,140 revolutionized core design

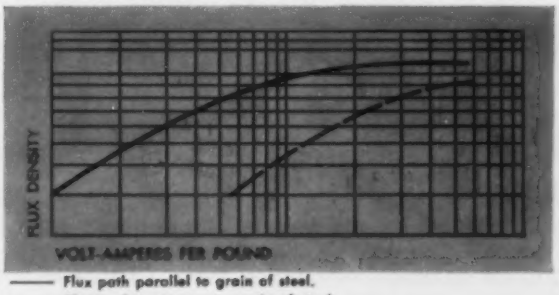
In 1933 Kuhlman was granted Patent #1,933,140 (application filed 1/29/29) on the radically different Bent Iron Core and by 1935 the new core was the first and only core of its kind on the market. The Bent Iron Core not only gained the electrical industries' unanimous acceptance but precipitated a revolution in transformer design, and today, through the use of better materials and improved manufacturing processes, the Kuhlman Core still retains its leadership over other types of cores. Compare the outstanding advantages of the Bent Iron Core's principle of lapped joint construction with other methods of core construction.



CORE CONSTRUCTION FEATURES	 A	 B	 C	 KUHLMAN
Flux density in joint area of core	High	Normal	—	Low
Core loss reduced in joint area of core	no	no	—	yes
Exciting current reduced in joint area	no	no	—	yes
Assembly of core after anneal prevents possibility of adhesions between laminations with resulting increase in core loss	yes	no	no	yes
Good space factor — windings in core window	yes	yes	no	yes
Extra copper in windings required by poor space factor	no	no	yes	no
Efficient design with no increase in over-all weights and dimensions	no	no	no	yes

Kuhlman Distribution Transformers are smaller and lighter

The cold rolled oriented silicon steel used in the Bent Iron Core permits the flux path to follow the grain of the steel resulting in a higher flux carrying capacity and a smaller, lighter core. Less copper is needed in the windings, thus reducing the size and weight of the coil. The smaller tank made possible by the Bent Iron Core and coil assembly makes Kuhlman Distribution Transformers easier and less expensive to handle, saves both storage and pole space, and permits the installation of higher KVA on poles.



—— Flux path parallel to grain of steel.
— — — Flux path transverse to grain of steel.

To get Bent Iron Core features order KUHLMAN Distribution Transformers

164

Ontario Makes 3-Prong Plug Mandatory in Homes

All homes in Ontario, Canada's most populous province, are likely to be rewired following a new ruling announced by the Ontario Hydro-Electric Power Commission.

As of June 1, all new or rewired homes and residential buildings must be equipped with wall outlets to accept the three-pronged safety plug. Such outlets will be mandatory in the kitchen, laundry, breakfast and utility rooms. There must be at least one in each room.

Basis for the ruling is safety. At present, all new homes and rewired residences must have grounded wall receptacles in the rooms where there is any possible contact with water pipes. The advent of automatic washers and dryers, hobby equipment and air conditioners has exposed the user to dangerous shortings.

Ontario Hydro officials estimate that within 10 years the complete changeover from two-prong to three-prong outlets may be a reality.

'Guaranteed Delight' Pulls More Sales Than Expected

Cleveland Electric Illuminating Co's "Guaranteed Delight" electric dryer campaign, (EW, April 25, p 55) pulled even greater sales than were anticipated. Final tabulations showed the campaign delivered sales jumps of 61% in February and a whopping 122% in March over the same months in 1954. The entire first quarter of 1955 reflected a 90% increase over the year-ago period. CEI officials earlier had expected 50% increase during the campaign's February-March duration.

UP&L Expands Trade-ins

After netting 2,040 old ranges as trade-ins during a 60-day campaign last year, Utah Power & Light Co is trying it again. This time the company will accept old water heaters (any type) as well as ranges as trade-ins on new units. Customer is allowed $25 on any old range or stove, $35 on water heaters, with UP&L reimbursing the dealer. Campaign runs through May 31, is limited to customers served directly by the company.

Westinghouse Electric Corp Photo

Mercury-Vapor Triples Library Lighting

Lighting levels were tripled and power requirements only slightly increased when incandescent lamps were replaced by fluorescent-mercury vapor units in this University of California library reading room at Davis. The existing fixtures weren't touched. Engineers simply substituted three 400-w fluorescent-mercury lamps for the 1000-w incandescent lamp in each of 26 fixtures. Result: lighting levels in the 60 x 160 ft room were upped from 10 to more than 30 ft-c. Ballasts are installed within the 35-ft ceiling, and fixtures can be lowered from their 26-ft mounting height to facilitate group relamping.

S&S SHORTS

Ups Farm Sales 55%

A 55% increase in electric sales per farm customer since 1950 is announced by Consumers Power Co. Said to serve more electrified farms than any other U.S. company (102,-694), Consumers Power reports average consumption per farm last year reached 5,207 kwh. This, it claims, is approximately 62% greater than the average 3,154 kwh estimated for other farms in eastern U. S. where irrigation loads are not a principal power use factor.

New Items

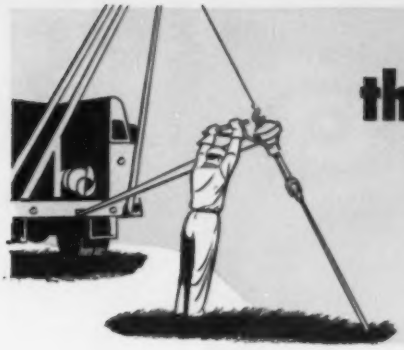
Surface-type power outlet, 30-amp and three-wire, with L-shaped slot to prevent interchanging with 50-amp units is announced by Harvey Hubbell, Inc, Bridgeport, Conn . . . Double-faced, portable radiant glass electric heater, thermostatically-controlled with automatic red "in-use" light is offered in its 1955 line by Continental Radiant Glass Heating Corp.

Cuts Electric Blanket Prices:

General Electric Co has reduced prices on its entire line of electric blankets with some models' price tags cut by as much as $15. Greater customer acceptance of electric blankets and expanded market are GE's reasons for cuts which it hopes will stimulate off-season market during the year's next two quarters.

New Griddle Won't "Kill"

A new electric griddle said to be the most powerful and fastest yet developed, will be marketed soon by Hotpoint Co's Commercial Equipment Department. The maker claims it can handle more than 700 quarter-lb frozen hamburgers per hour without "killing" its uniform high temperature, even under continuous loading.



the CHANCE "Blackfoot"

Holds more – Goes down faster

KING SIZE THIMBLEYE

The extra large eye of the Chance Blackfoot accommodates a turning bar big enough to make hand installation easy, and fits all hole boring machine adapters.

PITCH CONTROLLED

This accurately pitched, fast cutting blade really goes down fast. Every size anchor is individually "pitch controlled."

SMALLER HUB

The smaller hub on Chance Screw Anchors means less friction—easier installation. Less earth is disturbed during installation. That's why the Blackfoot has greater holding power.

CAN BE INSTALLED BY MACHINE TO CUT LINE CONSTRUCTION COSTS...

Give the Guy a CHANCE

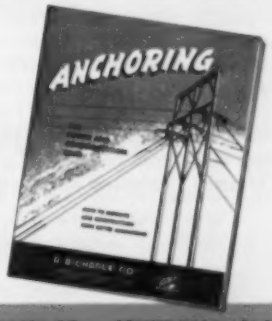
Power companies trying to trim costs can profit by the experience of a Florida Utility where the use of the big Chance 15 inch Screw Anchor was combined with machine installation to reduce anchoring costs.

The use of the fifteen inch Blackfoot permitted one anchor to take the place of several smaller ones. This added up to a considerable saving in material costs. Speedy machine installation—with fewer anchors to install—slashed installation time to a small fraction of what was previously required.

How did these anchors hold?

Company personnel conducted their own pull tests to determine the holding power of these Chance Anchors. The dynamometer showed *no* creep at 22,000 pounds!

You can protect your investment in line construction by specifying Chance Anchors for your guys. They really hold the load!



MIKE THE MOLE SAYS:

"Man, this book can help you 'dig' anchors better. GET YOUR COPY TODAY."

CA55-10

Here is the most complete guide to better anchoring ever developed. It's chock full of how-to-do-it material to help you select the right anchor for every guying job—and install it properly. It's FREE!

A. B. CHANCE CO. • 205 N. ALLEN ST. • CENTRALIA, MO.

O.K. Have "Mike" send us_____copies of "ANCHORING"

NAME_____

COMPANY_____

ADDRESS_____

CITY & STATE_____

NEW EQUIPMENT

Tree Trimmer Boom

Aerial boom device designed for overhead tree trimming is said to provide a higher degree of maneuverability, greater height and longer reach than earlier models. Lower boom of the Tree King moves through an arc of 135 deg, 45 deg past vertical. The truck-mounted unit enables a crewman at the controls to place himself at a height of 45 ft from the ground. Horizontal working reach from the turret is 32 ft with a working load of 300 lb. Auxiliary hydraulic controls are located at the base of the unit.

Crow's nest is made of molded Fiberglas and has no exposed metal parts. Upper boom is protected with chip-resistant insulation, laminated and bonded at the factory. A completely equipped working "package" is available consisting of a Tree King, truck, platform body with tool compartment, air compressor, pneumatic pruning tools, cab guard, and compressor guard.

Maxwell Equipment Co, Ford St, Milford, Conn.

Work Tower–Pole Setter

Elevating platform extends to a height of 60 ft and is easily converted to a derrick with a lifting capacity of 4,000 lb. It may be moved 15 deg from vertical to either side, or 15 deg ahead of vertical and 30 deg back, while fully extended. Direction and speed of movement may be controlled from the platform or at ground level. Platform measures 4.5 ft x 6.5 ft and has a capacity of 4,000 lb in most positions. Transforming the unit to a derrick is accomplished by removing the platform with the front mounted winch and attaching a head sheave for use with the winch for pole setting operations.

The unit is operated by hydraulic power, including the winch, which is driven by hydraulic motor. Relief valves are provided to prevent mechanism from being overloaded at any time. Complete unit can be mounted on any truck or tractor.

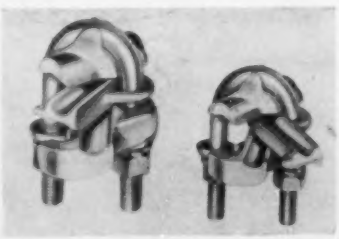
Elliott Construction Co, 503 Redick Tower, Omaha, Neb.

Hinged-Type Cable Clamps

Hinged-type U-bolt clamps are claimed to save considerable installation time. The angular position of the galvanized steel U-bolt with respect to conductors exerts a uniform clamping force on both cables. This force is said to be of sufficient magnitude to hold conductors loaded in excess of their rated tensile strength, without slippage. Clamps are made of high-strength aluminum alloy, except for the keeper which is soft aluminum to minimize cold flow of conductors. A cupped washer "locks in" both clamp and keeper to insure positive clamping.

Two sizes of clamps accommodate conductors from No. 6 to 2/0 ACSR and from 2/0 to 336.4 Mcm ACSR.

Line Material Co, Milwaukee 1, Wis.



(More New Equipment on page 118)

more protection for the public . . . at a new low cost to you

Hubbard's new Glo-Guard Guy Protector

● reflects brightly in headlight glare ● easily visible on dimly lighted streets or poorly lighted areas ● readily visible to pedestrians at night ● Cor-ten steel construction assures long life, high strength and light weight at a new low cost ● top quality double dip hot galvanizing assures superior resistance to atmospheric conditions

Protect the public from dangerous projections both day and night with Hubbard's new Glo-Guard Guy Protector, with the added feature of luminous areas that glow in the dark for additional visibility.

This new Hubbard guy protector is available in two lengths, 7 feet (Stock No. 718) and 8 feet (Stock No. 818), with attachment holes and clips designed for universal application to guy wires, rods or clamps. The clips and hole spacing allow the protector to be mounted close to the ground or at any height. Heads of attachment bolts are trapped so they will not turn as the nuts are tightened.

Hubbard Glo-Guard Guy Protectors are available for immediate delivery.

Your Hubbard representative will show you a model of this new Glo-Guard Guy Protector on his next call. If you want information immediately, please contact your nearest distributor or Hubbard and Company, 6301 Butler Street, Pittsburgh 1, Pa.

HUBBARD AND COMPANY

Pittsburgh 1, Pa.
Chicago 50, Ill.
Oakland 8, Cal.

special

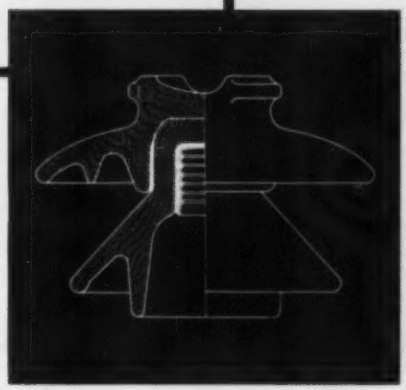
assembly TECHNIQUES
MAKE INSULATOR WINNERS, TOO!

The Pinco L-75R (Nocorona) conforms to EEI-NEMA Class 56-3

Only "Specials" . . . specifically designed to win the rugged Indianapolis "500" can win! And only *special* Multi-Part Pin-Type Insulators . . . specifically designed for high-voltage duty . . . can be "RIGHT-on-the-job"! PINCO makes them . . . extra special!

The design of Pinco Multi-Part Pin-Type Insulators places emphasis on RUGGED CONSTRUCTION . . . wet plastic process porcelain in husky sections with beaded edges to resist gun shot and handling breakage . . . special resilient compounds on surfaces in contact with cement to relieve all effects of thermal expansion. Pinco special cementing processes are laboratory-controlled. Porcelain sand grains of uniform size are applied in belts of even thickness and width. That's why when Pinco Multi-Part, Pin-Type Insulators go up —they STAY UP!

Thousands of Pinco Multi-Part Pin-Type, High-Voltage Insulators have been in service 35 years —with records of trouble-free performance to prove their rugged dependability. Let them prove it to you too!



Unit illustrated is Pinco L75R . . . "R" denotes "Nocorona" type which has an application of a special glaze at the critical points—The conductor and the tie wire grooves. This glaze being conducting, forms an intimate bond between the conductor, tie wire and insulator, thus eliminating the possibility of brush discharge (corona) from the conductor and tie wire to the insulator.

PINCO NO. L75R

Rated Voltage	45 kv.
Dry Flashover	125 kv.
Wet Flashover	80 kv.
Leakage Distance	21 in.
Mechanical Cantilever Strength	3000 lbs.

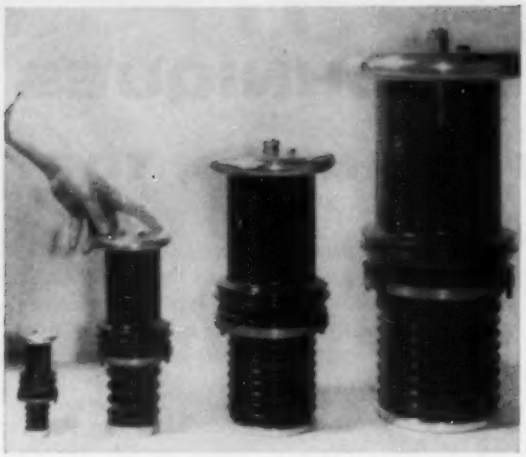
See Pages 36 to 39 . . . Pinco Catalog No. 49
for complete electrical and mechanical specifications or contact The Joslyn Mfg. & Supply Co., office in your locality.

PINCO INSULATORS

1920 35 1955 YEARS OF SERVICE TO THE ELECTRICAL INDUSTRY

The Porcelain Insulator Corporation
LIMA, N. Y.

Suspension Insulators . . . Clamps and Fittings . . .
Switch and Bus Insulators . . .
Distribution and High Voltage Pin Types . . .
Guy and Tree Insulators . . . Special Porcelain.



Apparatus Bushings

High-voltage apparatus bushings are designed for corona-free operation in test transformers, and for direct current and special frequency applications. Bushings are oil-filled and consist of a large diameter, sealed procelain housing. Conductor extending through the porcelain is designed to avoid internal corona. External corona is said to be eliminated by special design of porcelain and metal shielding.

Bushings are for indoor, vertical-upright mounting only, with the lower end in oil. They are claimed to be corona-free at rated voltage. Dry flashover is 30% higher than the corona-free voltage rating. A conductive coating between mounting surface and oil level eliminates corona formation above transformer oil. Bushings are available in ratings of 25, 50, 75, 100, 125 and 150 kv. A descriptive bulletin is available on request.

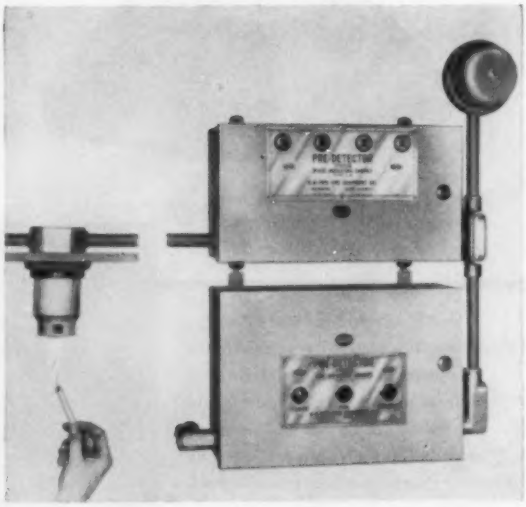
Lapp Insulator Co, Inc, Le Roy, N.Y.

Fire Detection System

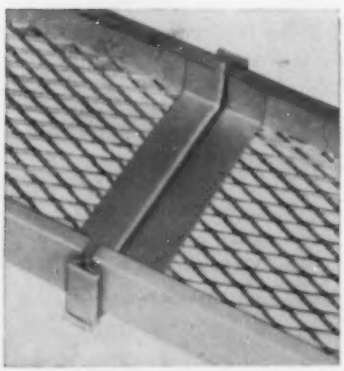
Fire detection device operates without dependance on visible smoke or heat for actuation. This automatic Pre-Detector System gives visual and audible alarms within seconds after the ignition of fires. Sensitivity of the system permits detection heads to be spaced up to 60 ft apart on centers or up to 30 ft from side walls.

Heart of the system is an overhead detection device electrically connected to a fire indicating cabinet. Each detection head contains a highly sensitive gas discharge (cold cathode) tube, plus two independent chambers, one of which is exposed to the atmosphere and the other virtually sealed from the atmosphere. A minute source of radioactive material is mounted in each chamber to ionize the air, causing it to become electrically conductive. Chambers are adjusted to give equal voltage when combustion gases or smoke are non-existent. When combustion gases or smoke are present the balanced condition no longer exists. The chamber exposed to the atmosphere rapidly changes its condition, causing the tube to become electrically conductive. This actuates a relay in a space indicating cabinet, if used, or the fire indicating cabinet.

As many heads as necessary can be connected on a single two-wire circuit to the fire indicating cabinet. The system may be used to activate fire extinguishing equipment or perform other functions



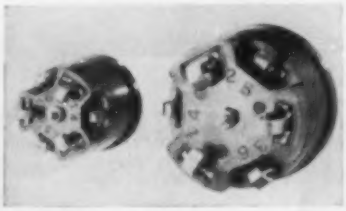
Pyrene—C-O-Two, U. S. H'way 1, Newark 1, N. J.



Cable Tray Coupler

Built-in coupler for cable trough with channel or expanded metal sides eliminates the use of bolts, nuts and washers. "Quick-Lok" couplers permit trough and fittings to be removed or inserted from side of run, or added after original installation. They are designed to fit any size or height of trough and are installed with a hammer. Bolt-on couplers are available for trough cut in the field.

P-W Industries, Inc, Duncan & Melrose St's, Philadelphia 24, Pa.



Overheat Protectors

Automatic reset overheat motor protectors for 3-phase, Y-connected motors are designed for original equipment installation. Protector consists

UPTEGRAFF

OVERHEAD TYPE UD TRANSFORMERS

for power distribution

WINDINGS

Long life is assured by the generous use of high rag-content fullerboard insulation, tied-in turns to meet short circuit forces and heat-reactive insulating varnishes.

CORE

Made from high-grade oriented-type steel. Has low exciting current and low noise level, and remains permanently tight to insure consistent, quiet performance.

TAP CHANGERS

Uptegraff designs feature accessibility, legibility, short-circuit capacity, non-deformable mountings, 360° rotation stops and exceptionally high insulation strength.

BUSHINGS

Securely clamped internally, with generous gasket area to prevent failure of seals. High-voltage bushings (under 15 KV) have spring-loaded contacts; low-voltage have tinned contacts; both for either copper or aluminum conductors.

TANKS

All parts are welded. Shot blasting assures adhesion of primer and finish coats of durable transformer paint. Rolled flange on cover permits high-pressure uniform gasket seal.

SIZES AND RATINGS

Type UD Transformers are built in sizes from 3 KVA to 100 KVA with ratings up to 15 KV.

Write for free copy of new bulletin that details characteristics and other pertinent data.

R. E. UPTEGRAFF MANUFACTURING CO.
Scottdale, Pennsylvania

R. E. Uptegraff Manufacturing Co.
Scottdale, Pa.

NAME_____

ADDRESS_____

CITY_____ STATE_____

EW

DESIGNED for quick, low cost trench digging for foundations and all types of service lines.

LADDER type permits efficient operation in the closest quarters and under difficult conditions.

CUTS up to 5 ft. in depth in 8" to 12" widths; 4 ft. in 14" and 16" widths; straight and clean.

THE NEW BUCKEYE 403

For Fast, Low Cost Utility Ditching

The 403 is a small, easy-to-maneuver machine for digging water, gas, sewer, building foundations . . . Low bearing electric or telephone lines and for pressure to avoid damage to lawns or walkways . . . Easily transported from job to job and will travel over almost any type ground. Digs a clean, straight-sided trench with squared corners. Complete details from your distributor.

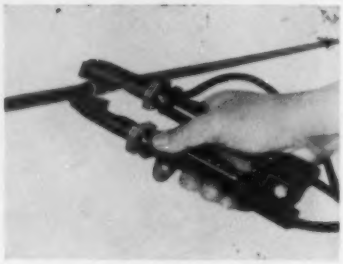
No. 5512

GAR WOOD INDUSTRIES, INC.
WAYNE, MICHIGAN

of a molded phenolic base assembly containing 3 heaters and a snap-acting thermal disc with 3 contacts. Design is such that 1 heater is in series with each phase of motor and 1 contact on thermal disc, which becomes the neutral point of the motor. When disc snaps open, connection is broken to neutral point, interrupting all 3 winding circuits.

Klixon protectors cover a range from fractional up to 7½ hp. They are available for single and dual voltage through 600 v.

Metals & Controls Corp, Spencer Thermostat Div, Attleboro, Mass.



Soldering Pliers

Electric pliers device for soldering copper tubing "sweat" fittings up to 1¼ in. diam can also be used on heavy electrical wire and cable, such as in heavy motor manufacture and power line work. Pliers operate from a 1,000-w portable power unit which can be energized from the nearest power outlet. A push-button heat control is located in handle of the pliers. Details in Bulletin No. 105H.

Wassco Electric Products Corp, Joliet, Ill.

"Canned" Motor Pumps

Hermetically sealed motor-pumps that handle radio-active water with zero leakage, can also be used to pump other fluids at system pressures up to 2,500 psi and temperatures as high as 650F. The units were originally designed to circulate water between nuclear reactors and steam generators in a high-temperature, high-pressure, closed loop system. Pumps can also be designed to handle liquids at pressures up to 10,000 psi and liquid metal at temperatures up to 650F.

Suction and discharge nozzles are

designed to be welded into the pipeline. Pumped fluid is allowed to fill the motor cavity, but is excluded from rotor and stator windings by sealing jackets in the magnetic gap. Parts in contact with pumped fluid are made of corrosion-resistant alloys. An external supply of ordinary clean water for cooling is the only auxiliary requirement. Pump capacities are from 5 to 17,000 gpm.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Recorders

General purpose, strip-chart recorders have plastic throw-away inkwells containing 3 oz of ink, triple the amount normally contained in an open type well. All the ink is used before disposal of the container since the minute pen opening has been de-

(*Continued on page* 124)

first choice in Motor Speed Controls

Variac®

Universal Rotating Band Welding Machine for applying rotating bands on 75mm to 155mm shells. Developed by the Morley Machinery Corporation, Rochester, N. Y., for the Pitman-Dunn Laboratory of the Frankford Arsenal.

To control headstock spindle speed over wide ranges, smoothly and with no "chattering", Morley-Machinery design engineers chose a G-R Type 1700-B Variac Motor Speed Control. For setting spiral feed accurately with provision for rapid starting and stopping, they chose another Variac Motor Speed Control.

These designers had to be sure these controls would perform day after day under severe operating conditions. They looked the field over, made tests . . . . . and finally selected G-R Variac Motor Speed Controls. Here are the reasons for their choice. . . . .

- The Variac Motor Speed Control operates from 50-60 cycle a-c power . . . . . converts this power to dc . . . . . and makes available all the advantages inherent in operation of d-c motors
- Operation is smooth . . . . . a simple knob adjustment permits rapid, *continuous* speed control from zero to full rated speed . . . . . there are *no pulsations when operating at steady speed*
- Starting, stopping and reversing is accomplished *instantly* with a flick of a switch . . . . . there is no creep whatever when set to zero
- This control uses selenium rectifiers, has no electron tubes . . . . . is rugged . . . . . insures long life with minimum maintenance

G-R Variac Motor Speed Controls . . . . . available in a variety of sizes from 1/15 to 1-1/2 hp. Operation is from ordinary 115-Volt lines.

Where a manufacturer wishes to combine this control with equipment of his own manufacture, in his own cabinet, the basic elements are provided as a sub-assembly.

Type 1701-A for Motors of	1/15th hp and less	$75.00
Type 1703-A	1/12 to 1/6 hp	87.50
Type 1700-B (Illustrated)	1/4 and 1/3 hp	170.00
Type 1702-A	1/2 and 3/4 hp	245.00
Type 1704-A	1 hp	470.00
Type 1705-A	1-1/2 hp	495.00

Strip-down models range from $87.00 to $328.00

Fill in Coupon Below for Complete Information

GENERAL RADIO Company 275 Massachusetts Avenue, Cambridge 39, Massachusetts

Please send me complete information on VARIAC Motor Speed Controls

Name _____

Company _____

Street _____

City _____ *Zone* _____ *State* _____

Enjay now foremost butyl rubber supplier

90,000 tons yearly production of Enjay Butyl, now available from its originators, will go into varied industrial products

Enjay Company, Inc., a pioneer and leading supplier of petroleum chemicals, will market Butyl and supply advisory service in its applications.

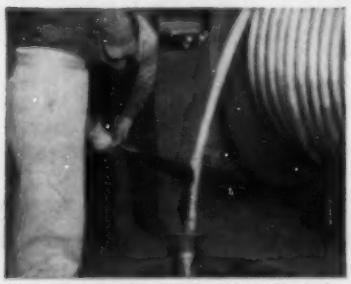
The low price and high-level performance of Enjay Butyl allow it to replace natural and other rubbers now used in industry. Enjay Butyl is the rubber that combines high resistance to aging . . . abrasion . . . tear . . . chipping or cracking . . . ozone or corona . . . chemicals and gases . . . heat . . . cold . . . sunlight . . . and moisture.

The new Enjay Laboratories, located at Linden, New Jersey, are equipped to provide expert technical assistance in compounding and adapting Enjay Butyl to individual uses and requirements.

Distinctive properties and low price give Enjay Butyl wide industrial application

Inner tubes are made of BUTYL because BUTYL holds air ten times better than natural rubber. Its impermeability to gases promises many uses.

1955 cars use Butyl for dozens of rubber parts, because BUTYL has super-durable resistance to aging or deterioration on exposure to heat, cold, sun, weather, and chemicals.



High voltage electrical cables are made with BUTYL because BUTYL offers superior corona and ozone resistance, combined with excellent heat, cold, and abrasion resistance.

Tractor tires are made with BUTYL because BUTYL gives low tread wear and high resistance to weather, cracking, cutting, and chipping.

Protective clothing, tank linings, belt covers, hoses, and other equipment in contact with chemicals use BUTYL because of its exceptional resistance to chemicals.

GIANT TOWERS at a plant producing Enjay Butyl reflect the massive achievement of manufacturing rubber from petroleum.

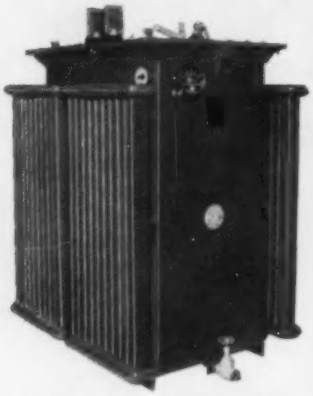
FOR FULL INFORMATION
and technical assistance on applications or supply of ENJAY BUTYL, write or phone

ENJAY COMPANY, INC.
MAIN OFFICE: 15 West 51st St., New York 19, N. Y. Tel. PLaza 7-1200.
DISTRICT OFFICE: 11 South Portage Path, Akron 3, Ohio.

ENJAY BUTYL

more and more

engineers of leading industries are specifying



250 KVA, Oil Immersed, Self-Cooled Distribution Transformer, Type LS.

Marcus

TRANSFORMERS

for trouble-free operation and performance beyond specifications

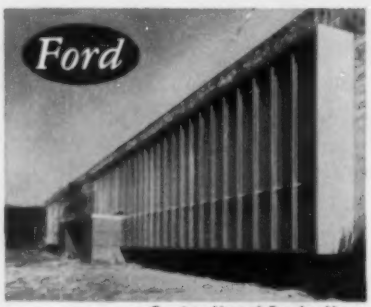
A COMPLETE LINE OF OIL IMMERSED, ASKAREL, AND DRY TYPE TRANSFORMERS up to 5000 KVA

- POWER
- DISTRIBUTION
- UNIT SUBSTATION
- GENERAL PURPOSE
- PHASE CHANGING
- ELECTRIC FURNACE
- RECTIFIER
- WELDING
- MOTOR STARTING
- SPECIAL

Marcus Transformers installed for lighting distribution in new Ford plants near San Jose, California, Louisville, Kentucky, and Mahwah, New Jersey as part of the Ford Motor Company's huge coast-to-coast multimillion dollar expansion program.

Architects
Albert Kahn Associates — Giffels & Vallet and L. Rossetti

Electrical Contractors
Fischbach and Moore, Inc.—San Jose, Calif.
Hatfield Electric Company—Louisville, Ky.
A. Neri, Inc.—Mahwah, New Jersey



Courtesy Newark Evening News

South front of beautiful, ultra-modern office section of new Ford plant at Mahwah, N. J.

"Mark of Quality"

Representatives in Principal Cities

Marcus

TRANSFORMER CO., INC.

RAHWAY, NEW JERSEY

New Equipment

(*Continued from page* 120)

signed to cut evaporation to a negligible amount. Designated Type CH, three models—portable, semiflush or surface mounted—chart a continuous record of an electrical quantity against time.

Record rolls are 150 ft long to permit less frequent changing. They utilize light green lines for sharp contrast with the standard red ink. Up to 28 chart speeds are available ranging from ¼ in. per hr to 2 in. per sec. The portable model's dimensions are: 10½ in. wide; 17⅝ in. high; 13 in. deep.

General Electric Co, 1 River Road, Schenectady 5, N. Y.

Lightning Arresters

Protective performance of Thorex GP lightning arresters has been improved approximately 15%, according to the manufacturer. This improvement is said to be based upon maximums wherein full tolerance is added to average published values. Increased protection results from a new series gap design which provides higher interrupting ability. Composition of valve blocks has been altered and refined to exploit the advantages of this gap in terms of lowered IR discharge voltages.

Other Thorex arresters, Types MP, MPR and RM have also been

In Growing Florida's Largest Power Plant...

CADWELD CONNECTIONS PLAY A VITAL ROLE!

Florida's really growing places! In population gains, in light industry growth—the Sunshine State is among the nation's leaders.

To meet this tremendous power demand Florida Power and Light Company—largest power supplier in the state—spent a record $41,700,000 in 1954 alone, a total of $250,000,000 since V-J Day.

In power plants such as Cutler near Miami, which by midsummer 1955 will have 380,000 kilowatts capacity, and in substations throughout the state CADWELD connections help FP&L speed its gigantic $410,000,000 construction program.

For in fabulous Florida—where industry finds a business climate as favorable as the natural climate—power engineers have found CADWELD connections are best because:

1—They do not require mechanical pressure for contact.

2—They cannot loosen or corrode.

3—They have greater current carrying capacity—this keeps connections operating cooler than the cable.

4—They are compact—thus simplifying reinsulation.

CADWELDED . . . this #2/0 stranded copper cable ground wire to 69 KV steel structure.

Compact, trouble-free CADWELD connections—more than 4500 of them—are used in FP&L's Cutler plant switchyard shown below.

CADWELD®

Erico Products, Inc.

2070 E. 61st Place • Cleveland 3, Ohio

IN CANADA: ERICO INCORPORATED, 3571 Dundas St., West, Toronto 9, Ontario

You'll like Porcelain Products' metal reinforced No. 1986 wireholder. They're built to standards of ruggedness and reliability that assure top performance for generations. Metal in tension, porcelain in compression—hot dip galvanized steel parts—extra sharp, lubricated threads—large pulley-action wire hole makes this the finest wireholder on the market.

A complete line of secondary service materials built to the same high standards of quality and dependability are also available for every service installation.

You can depend on the name Porcelain Products—the byword for "Quality" for more than 60 years.

ELECTRICAL PORCELAIN SINCE 1894

61 years

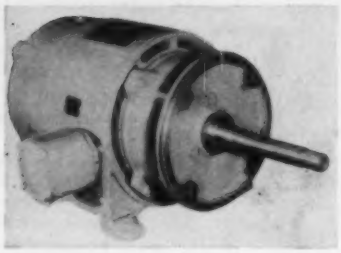
Porcelain Products, Inc.

PP INC.

FINDLAY, OHIO

equipped with improved valve blocks. This is claimed to provide a corresponding increase in protective performance at operating ranges extending to 300 kv. Details in Publication No. 1338-H.

Ohio Brass Co, Mansfield, Ohio

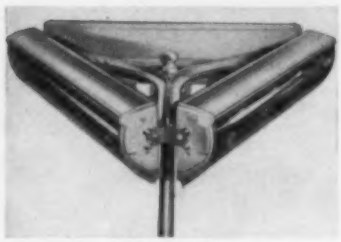


Pump Motors

A line of totally-enclosed and explosion-proof, close-coupled motors has been designed for use with centrifugal pumps operating in dangerous, damp or dusty locations. Special features include a face type registered mounting bracket for accurate shaft alignment and simplified pump mounting; precision ground shaft for accurate impeller mounting; and solid flange and brass slinger for complete liquid deflection.

Motors are available in ratings ranging from 1½ to 25 hp. Smaller ratings are self-cooled by radiation. Larger ratings are double-enclosed and fan ventilated.

U. S. Electrical Motors Inc, Box 2058 Terminal Annex, Los Angeles 54, Calif.



Fluorescent Luminaire

Delta-shaped fluorescent luminaire offers high illumination but low average brightness. It is designed for parking lots, railroad yards, work areas, or similar applications.

The unit emits an IES Type V light distribution pattern. Each leg,

Latest in HF

COMMUNICATIONS BY *Collins*

Collins new high frequency equipment has wide application in the ground-to-plane, shore-to-ship and point-to-point communication field. Modern circuitry assures the highest performance over a wide frequency range. Excellent receiver selectivity, together with maximum transmitter harmonic attenuation assures freedom from interference in areas where channel frequencies are closely spaced.

COLLINS 430 Series offers a choice of 12 transmitters to meet your individual communications requirement. Frequency range is 2.0 to 30.0 mc. Automatic channel switching on ten pre-set frequencies from a local or remote position is available when Collins Autotune is employed. Provision is made for use of master oscillator. Power output: 431 series — 1,000 watts CW, FSK or AM voice; 432 series — 2,500 watts CW or FSK, 2,000 watts voice. Frequency stability is .003% for CW or voice and .0005% for FSK.

COLLINS 512B-2 RF Impedance-conversion unit may be used in the range of 2 to 30 mc to couple unbalanced 52-ohm transmitter output to a 600-ohm balanced transmission line. No tuning is required.

COLLINS 51J-4 Double Conversion Superheterodyne Receiver is designed for top performance from 0.54 to 30.5 kilocycles. A crystal controlled high frequency oscillator and highly stable low frequency oscillator permit accurate linear calibration of one dial division per kilocycle on all bands. The Collins Mechanical Filters give the 51J-4 the closest approach to ideal selectivity ever achieved in a communications receiver designed for AM, CW, MCW, and FSK reception.

COLLINS 51N-2 Receiver provides voice, CW and MCW reception at any one crystal controlled frequency in the 2 to 24 megacycle range. Image rejection is 60 db throughout the range. Sensitivity is better than 5 uv for a 10 db signal-to-noise ratio. Provision is made for remote control.

Write for descriptive literature.

COLLINS RADIO COMPANY

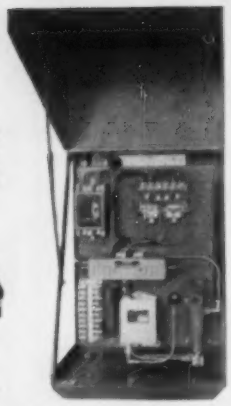
CEDAR RAPIDS, IOWA

261 Madison Avenue, NEW YORK 16, NEW YORK
1200 18th Street N. W., WASHINGTON, D. C.
1930 Hi-Line Drive, DALLAS 2, TEXAS
2700 W. Olive Avenue, BURBANK, CALIFORNIA

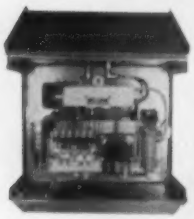
COLLINS RADIO COMPANY OF CANADA LTD.
74 Sparks Street, OTTAWA, ONTARIO

COLLINS

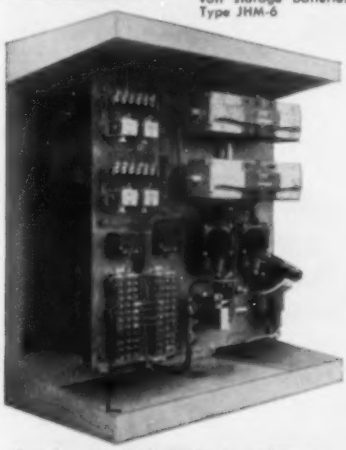
Hydraulics
FOR GROUP OPERATED
AIR BREAK SWITCHES



For remote operation, this hydraulic motor mechanism uses standard voltages, a. c. or d. c. Type JHM



For remote operation, this mechanism incorporates 6-volt storage batteries. Type JHM-6



Stored energy in a hydraulic accumulator actuates Type JHA, independent of station power

• Hydraulic operation of air-break switches, originated by Royal in 1948, has proved to be as great an improvement in power switching as hydraulic brakes were in your car about 30 years ago. Hydraulic operation is smoother, easier, more positive, and less subject to wear. Instead of complicated and expensive mechanical linkages, copper tubing is used to conduct the actuating force. Tubing readily conforms to the shape of any switching support or substation, and permits operation at distances of as much as 100 feet from the switch to the hydraulic mechanism. Royal hydraulic mechanisms have proved their dependability, flexibility, and low cost in over 200 installations. They can be installed on either existing or new group-operated switches. They are now available for remote operation from any a.c. or d.c. voltage (Type JHM), from storage batteries (Type JHM-6), or from energy stored in a hydraulic accumulator (Type JHA). May we send you descriptive literature?

40 Years of Service to the Electrical Industry

Royal

A Part of the Arsenal of AMERICAN POWER PRODUCTION

ROYAL ELECTRIC MANUFACTURING COMPANY
INCORPORATED
1122 EAST 87th STREET Chicago 19, Ill.

Designers and Manufacturers of Power Switching Equipment and Special Electrical Devices

rated at 245 w, accommodates two 100-w, 6-ft, T12 lamps. Main beam output of one leg is about 4240 candle power. Average unit brightness is 3 candle power per sq in. Brightness level is said to be 1/20 of that of conventional small source luminaires having similar light distribution. Each lamp has individual reflecting surfaces to control vertical light distribution. One ballast is furnished for each leg of the delta.

Metallic parts are aluminum, except for non-ferrous fittings. Covers are translucent plastic, hinged at the top and latched at the bottom. Cover gaskets make the luminaires weatherproof and bug-proof.

Line Material Co, Milwaukee 1, Wis.

Control Instrument

Automatic, all-electrical device initiates action when switchboard or panel instruments read a predetermined value. Control system picks up signal from instrument pointer without any mechanical contact. System is suitable for one-set point or two-set point initiation and is supplied with a spdt load relay rated at 120/240 v, 10/5 amp.

Typical applications are: (1) To sound alarm when temperature reaches a critical value, (2) to initiate control to contain frequency within a specified range, (3) to shut down equipment at a maximum vibration point, and (4) to shut down machinery drawing more than normal power.

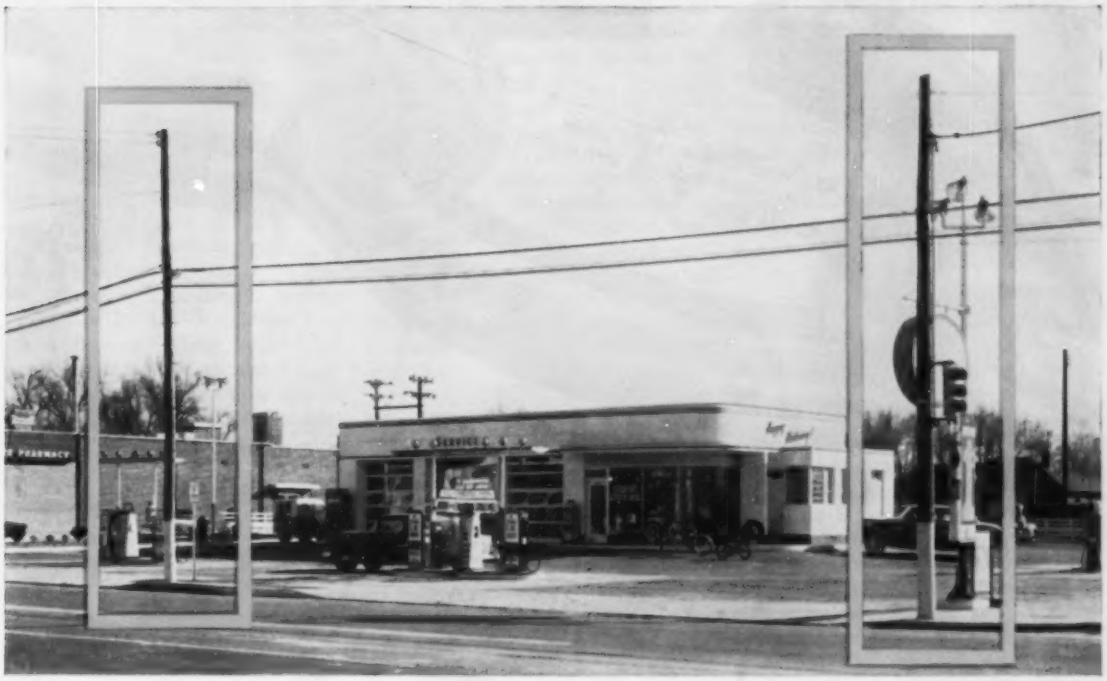
General Electric Co, 1 River Road, Schenectady 5, N. Y.

(*More New Equipment on page* 131)

DOW

PENTA

clean wood preservative protects joint-use poles from rot and termites—at no sacrifice in appearance



THE DOW CHEMICAL COMPANY
Dept. PE-8448J, Midland, Michigan

☐ Send me additional information on PENTA-treated poles.

☐ Send me a list of PENTA-treating plants.

☐ Tell me how PENTA protection can actually be measured.

Name_____

Title_____

Company_____

Address_____

City_____ Zone____ State_____

Clean PENTA-treated poles are equally "at home" on metropolitan street corners and busy farms. Whatever the conditions of use and exposure to rot and insects, poles treated with PENTA* wood preservative resist costly decay and termite attack *far better* . . . stay up *far longer* . . . cut replacement and maintenance costs sharply.

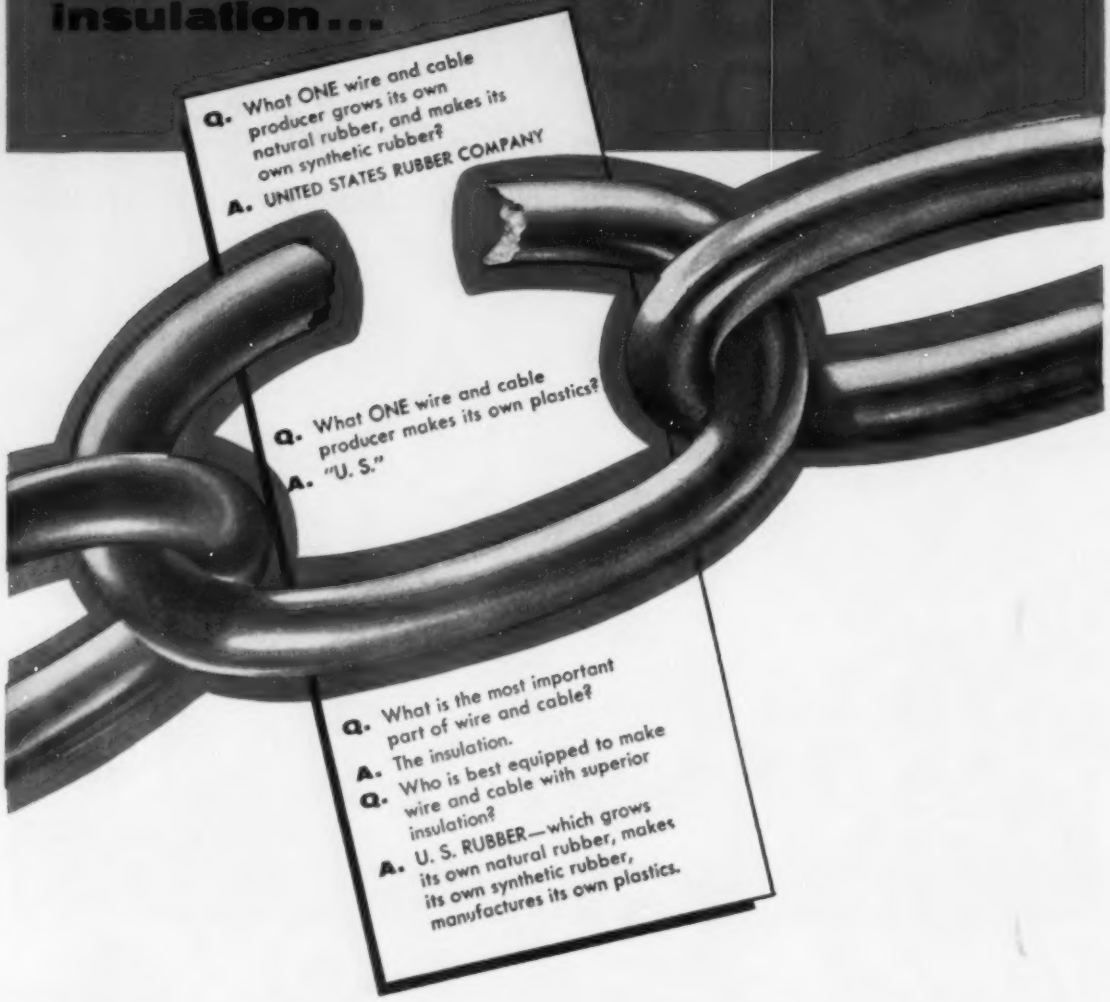
Another prime reason telephone, light and power companies and other major pole users specify PENTA: *appearance.* This modern, single-compound preservative leaves wood with a natural, attractive look. Clean PENTA-treated poles make good neighbors while meeting the most strict civic requirements.

Over 100 suppliers now provide PENTA-treated poles and crossarms carefully checked for proper retentions. Ask *your* regular supplier about the tested benefits of effective *PENTA-chlorophenol. And for new information about how simply PENTA protection can actually be *measured*, mail coupon to THE DOW CHEMICAL COMPANY, Midland, Michigan.

you can depend on DOW CHEMICALS

DOW

Electrical wire is no stronger than its insulation...


Q. What ONE wire and cable producer grows its own natural rubber, and makes its own synthetic rubber?
A. UNITED STATES RUBBER COMPANY
Q. What ONE wire and cable producer makes its own plastics?
A. "U. S."
Q. What is the most important part of wire and cable?
A. The insulation.
Q. Who is best equipped to make wire and cable with superior insulation?
A. U. S. RUBBER—which grows its own natural rubber, makes its own synthetic rubber, manufactures its own plastics.

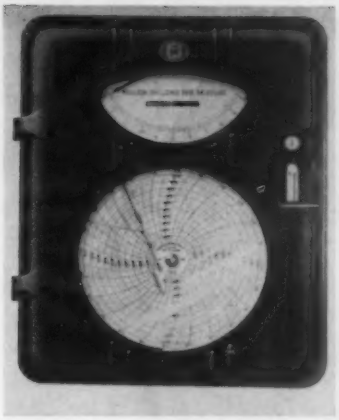
ELECTRICAL INSULATION IS A "U. S." SPECIALTY!

Isn't it logical that a rubber company should make the best wire and cable insulation there is? U.S. Rubber has been a pioneer in insulation for close to 70 years—has amassed in that time a stockpile of research data and experience that can't be beat. Electrical insulation is a "U.S." specialty! Electrical insulation makes the difference between superior and ordinary wire and cable. Conductors of all manufacturers are standard, but insulation must be the best that science can produce. That's why your best bet in wire and cable is U.S. Rubber.

US RUBBER

UNITED STATES RUBBER COMPANY

ELECTRICAL WIRE & CABLE DEPARTMENT • ROCKEFELLER CENTER, NEW YORK 20, N. Y.



Data Transmitter

Electrical transmission instrument is designed for remote transmission of flow or other measurable data over long distances. Orthoflow utilizes a two-wire circuit and can be adapted for use over private lines in in-plant services or for use over leased telephone channels. It can be modified for use in explosive locations.

Transmitting units may be applied to mercury cylinders of varying sizes to produce measurements over 4-1, 10-1, 13-1, 18.5-1, and 20-1 ratios with accuracies not exceeding ±2%.

Simplex Valve & Meter Co, 7 E. Orange St, Lancaster, Pa.

Panel Voltmeters

Expanded scale, panel mounting voltmeters offer a linear design which includes only the useful portion of the scale. Meters are accurate to 0.5% of input voltage.

Standard base voltages range from 6.25 to 230 v with span that can vary from 4 to 5% of base voltage. Models available are: 2½ and 3½ in. round or square, 4½ in. round, and 4 x 6 in. rectangular.

Beckman Instruments Inc, 220 Pasadena Ave, South Pasadena, Calif.

Generator Sales Co, 1627 N. Damen Ave, Chicago 47, Ill., has a **portable welder,** with capacity of large industrial units, that is small and light enough to be hand carried. Model 2BW's output is 15 to 140 amp. It operates on 110 or 220 v, ac or dc.

Hardwick, Hindle, Inc, Newark 5, N. J., offers a line of **rheostat-potentiometers** with capacities up to 1,000 w for motor speed control, arc welders, generator field controls, etc. Ask for Bulletin 355.

Rice-Peterson Sales, Inc, Box 1114, Palo Alto, Calif., has a portable kit for magnetic particle inspection that requires no power source for operation. The SempuN Magnetic **flaw detector** is a permanent magnet with ball pivots and multi-self-adjusting magnetic pins which permit good contact on any size or shape of part. It indicates sub-surface as well as surface flaws.

Rapid Electric Co, 2881 Middletown Rd, New York 61, N. Y., offers germanium **rectifiers** with 95% efficiency at full load. Models are available with outputs from 300 to 50,000 amp dc. Inductor controls vary output from zero to full rated load at the touch of a button.

General Electric Co, Pittsfield, Mass., offers a compact hook-on **volt-ammeter** that fits into the palm of a man's hand. Types AK-5 and AK-4 permit measurements to be made on both insulated and uninsulated circuits without interrupting service. A scale and range changing mechanism provides seven ranges with calibrated scales.

General Electric Co, Schenectady 5, N. Y., has a line of **component rectifiers,** called Vac-u-Sel, which includes rectifier cells with peak inverse rating of 63 v; cells which will operate up to 130C ambient temperature; and cells with a life expectancy of 60,000 hr. High temperature cells are rated 26 and 45 v; low temperature cells, 26 v.

Edwin L. Wiegand Co, 7500 Thomas Blvd, Pittsburgh 8, Pa., has all-metal **far-infrared electric heaters** for industrial baking, drying, curing and dehydrating operations. One type has a standard medium screw base and another has bi-post terminals.

Mystik Adhesive Product, 2635 N. Kildare Ave, Chicago 39, Ill., has No. 7000-G **tape** which is said to combine both high tensile and dielectric strengths with excellent bonding abilities at temperatures ranging from −100F to +550F. It is classified as Class H insulation.

Electrons, Inc, 127 Sussex Ave, Newark 3, N. J., is producing two Xenon filled **thyratrons** having identical electrical characteristics for application in motor control and ignitor firing circuits. Type EL C4J is for socket mounting and Type EL C4J/F for panel mounting.

Perkin Engineering Corp, 345 Kansas St, El Segundo, Calif., offers a 125 v, 25 amp germanium rectifier dc **power supply.** Model No. G 125-25 has 4% voltage regulation from no load to full load . . . Hickok Electrical Instrument Co, 10572 Dupont Ave, Cleveland 8, Ohio, has a Model 770 **oscilloscope** with a 5-in. screen, wide range and high sensitivity.

Torsion Balance Co, Clifton, N. J., has subminiature **toggle switches** which reduce by half the size and weight heretofore required. Switches are double-throw in sp and dp types. Contacts are rated for 10 amp at 50 v dc . . . Potter Instrument Co, 115 Cutter Mill Rd, Great Neck, N. Y., has **circuit elements** which are said to have all the advantages of transistors and magnetic cores without attendant disadvantages. Magnistors are classified as amplifiers or bistable storage devices. They are not affected by temperature extremes and will operate from 0 to 30 million cycles.

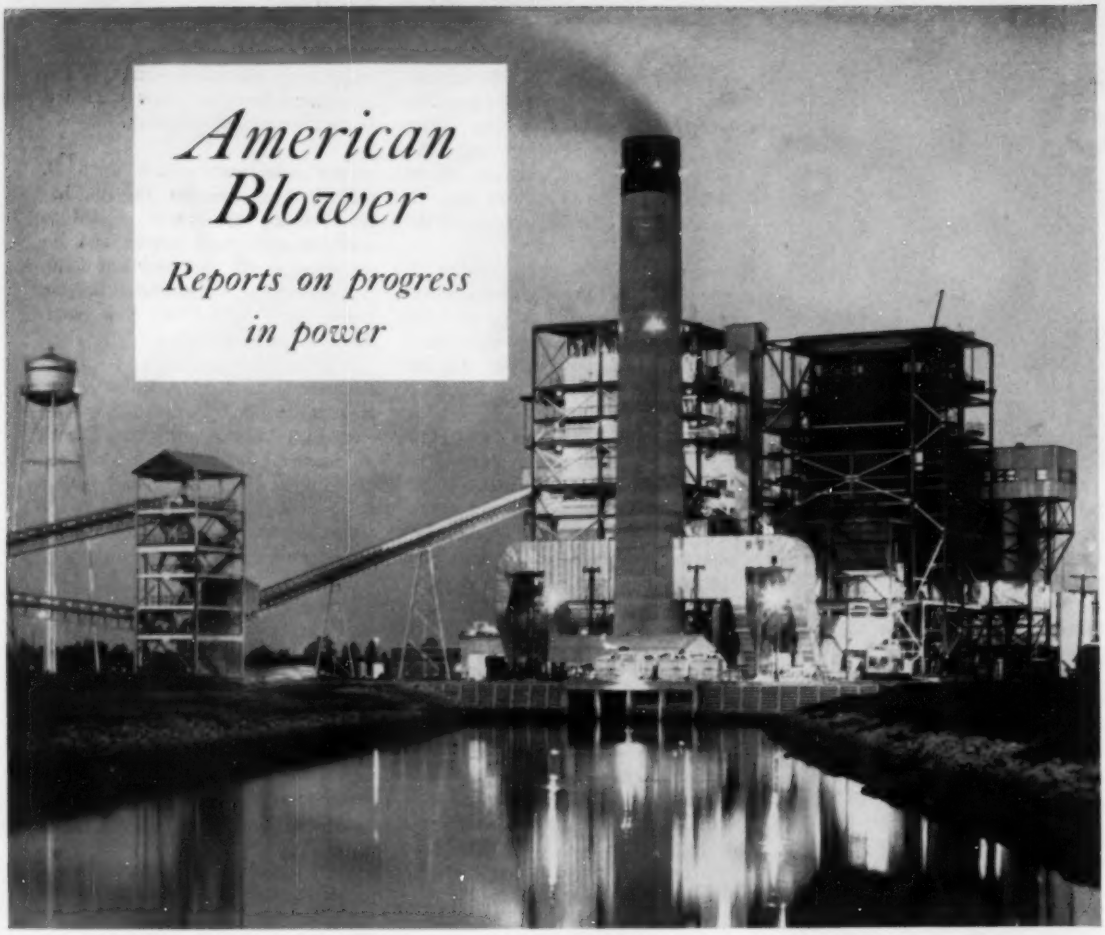
American Solder and Flux Co, 19th & Willard Sts, Philadelphia 40, Pa., has a stearine **fluxing stick** for lead cable sleeve soldering. The stick contains an activating agent which works with the stearine to completely dissolve metal oxides, thus enabling solder to flow freely at all times.

Electro-Measurements Inc, 4312 S.E. Stark St, Portland 15, Or., has a

(*Continued on page* 134)

American Blower

Reports on progress in power



CP&L's new plant at Wilmington, N.C., has been named the *Louis V. Sutton Steam Electric Generating Plant* in honor of the company's president. The first mammoth boiler of this outdoor-type unit towers 17 stories high, and produces steam up to 1,000° F with 1,600 lbs. pressure per sq. in. CP&L's system includes three other large fuel-burning plants, plus three large hydroelectric plants.

For new #1 unit of Louis V. Sutton Plant, CP&L installed these two American Blower Sirocco Induced Draft Fans. Each is rated @ 225,000 cfm @ 585 rpm @ 291° F @ 16" sp. If *your* plans call for mechanical draft equipment, fly ash precipitators, heavy-duty steam coils, or fluid drives for boiler feed pump and fan control — contact your American Blower Branch Office, today.

Serving home and industry: **AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS &**

Carolina Power & Light Co. ups capability to 922,000 kw with new outdoor unit

Carolina Power & Light Company's new steam plant reflects design progress, uses American Blower Draft Fans

The new Louis V. Sutton Steam Electric Generating Plant at Wilmington, N.C., is the Carolina Power & Light Company's first plant of outdoor-type construction to be built entirely above ground. No. 1 unit, which went into operation July 1954, adds 105,000 kw to CP&L's generating network, boosting total capability to 922,000 kw!

Laid out for a maximum of six generating units, this new plant will be the largest in the company's vast system . . . a system that serves over 2,000,000 people in 30,000 square miles of the Carolinas. Its outdoor design saves on construction costs and time, and reflects CP&L's many years of progress: continually expanding and increasing service to customers.

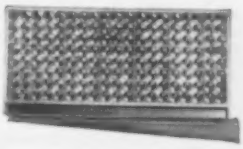
Along with cost-cutting outdoor construction, CP&L chose efficient and dependable equipment, including American Blower Forced and Induced Draft Fans.

Across our nation, progressive, investor-owned utilities prefer American Blower equipment because it performs at peak efficiency, indoors or out, with minimum maintenance. They know you can rely on American Blower's Forced and Induced Draft Fans, Fly Ash Collectors, Gyrol Fluid Drives for boiler feed pump and fan control, and Heavy-duty Steam Coils.

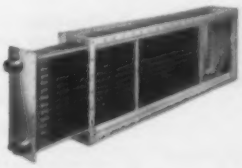
May we assist in *your* progressive program? Give your nearest American Blower Branch Office a call, or write us direct.

This is one of two American Blower Sirocco Forced Draft Fans installed on #1 unit at CP&L's Louis V. Sutton plant. It is rated @ 140,000 cfm @ 585 rpm @ 100° F @ 14.4" sp.

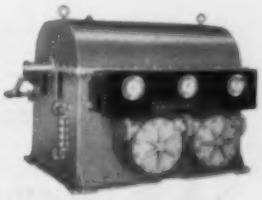
Mechanical Draft Fans for induced and forced draft



Collectors and precipitators for dust and fly ash control



Heavy-duty steam coils for high pressure duty



Gyrol Fluid Drives for boiler feed pump and fan control

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN • CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER

WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

More New Products

(*Continued from page* 131)

fault locating Wheatstone bridge designed for field operation. As a Wheatstone bridge, resistance within a zero to 1.2 megohm range can be measured directly. For fault locating measurements, Varley Loop ratios are 1/1, 1/4 and 1/9; Murray Loop ratios include 10, 100 and 1,000. It can also be used as a continuity checker, and provision is made for making capacitance checks for open line test with use of an external capacitance standard and tone source.

Rust-Oleum Corp, 2425 Oakton St, Evanston, Ill., has Galvinoleum for **coating new or old galvanized metal** surfaces without etching treatment. Coating may be applied by brush or spray and is available in red, gray, metallic or green . . . Smithcraft Lighting Div, Chelsea 50, Ill., has heavy duty industrial **lighting fixtures** which provide 10% uplighting to minimize glare caused by contrast between lighted and dark areas.

Associated Research, Inc, 3760 W. Belmont Ave, Chicago 18, Ill., offers Model 424 dc Hypot for **dielectric testing** up to 5000 v and insulation resistance up to 50,000 megohms.

Foxboro Co, Foxboro, Mass., has **chart paper** which improves legibility of instrument records. Circular and strip charts are designed for use with sediment-free Type 1500 general purpose ink and Type 316 stainless steel pens.

Triangle Conduit & Cable Co, Inc, New Brunswick, N. J., offers **E.M.T.** with a smooth glossy coating inside to facilitate wire pulling. Outside is galvanized with 99.9% pure zinc.

Illinois Testing Laboratories, Inc, 420 N. La Salle, Chicago 10, Ill., offers a distant reading **electric thermometer** for measuring temperatures at 50 locations as far as 1,000 ft away. Ranges are available between −100F and 400F.

Victory Engineering Co, Union, N. J., has a portable **electric thermometer** for use in air, liquids and bulk materials. The Temprobe unit consists of a meter, two extension tubes and a temperature sensing probe.

CATALOGS AND BULLETINS

● **WESTINGHOUSE BULLETINS:** The following are available from Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Booklet 52-600, 20 pages, discusses technical aspects of Magamp **magnetic amplifiers** for control applications. Charts, graphs, and circuit diagrams illustrate component parts, applications, and operating characteristics of amplifiers having a power output of 0.03 to 325 w, 6.3 to 230 v, 0.15 to 1.7 amp.

Bulletin 85-871 describes **induction heating equipment** for hardening, annealing, brazing, forging, and heat-treating of metals. It discusses high-frequency motor-generator sets with output frequencies of 960, 3000, and 9600 cps, with power ratings of 30 to 1500 kw, and higher.

Bulletin B-5799-B summarizes salient features of **fluorescent luminaries** for commercial and industrial use.

Booklet B-6525 describes performance and applications of consumable electrode inert gas **welding process.**

● **TAPE:** A 4-page brochure entitled "Permacel 2 in 1 Electrical Tapes" discusses the application of one tape doing the work of two. Permacel Tape Corp, New Brunswick, N. J.

● **RESISTORS:** Data Sheet EB2(1), 4 pages, gives electrical characteristics and construction features of fixed ac and dc resistors. Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa.

● **ALLIS-CHALMERS BULLETINS:** The following are available from Allis-Chalmers Mfg. Co, 932 S. 70th St, Milwaukee, Wis.

An 8-page leaflet, 05R8234, contains test performance data on a **fully supercharged generator.** It summarizes and compares observed temperatures, losses, efficiencies, and characteristics of this generator with those of conventionally cooled machines.

"The ABC's of Transformer Design and Application" is a simplified explanation of the fundamentals of **transformer design** and construction.

Bulletin 03R8221 describes advantages of close-coupled design to reduce floor area of high capability cross-compound reheat steam **turbine generator units.**

Bulletin 15B7217B describes construction, operation, and applications of electronic **metal detectors.**

● **METAL FILLER:** A 4-page bulletin describes uses of synthetic metal in putty and liquid form. A. L. Okun Co, 109-02 Van Wyck Expressway, Long Island 20, N. Y.

● **LIGHTING:** A booklet entitled "Better Seeing Builds Better Sales" is a factual treatise covering the economics and mechanics of good store lighting. It discusses methods of mounting fixtures and the use of fluorescent and incandescent lamps. Sylvania Electric Products Inc, 1740 Broadway, New York 19, N. Y.

● **MINNEAPOLIS-HONEYWELL BULLETINS:** The following are available from Minneapolis-Honeywell Regulator Co, Industrial Div, Wayne & Windrim Ave's, Philadelphia 44, Pa.

No. 9060 Describes and illustrates **servo controllers** for system load and frequency control.

No. 8506 Gives information for selection of bodies, linkages, and power units for **motorized valve assemblies.**

Specification Sheet 602 Describes internal **cam programmers** designed to maintain a definite relationship between temperature and time.

No. 8410 Describes an automatic **ratio relay** for use in automatic control and computing systems.

No. 1161 Contains a discussion of basic principles of **liquid level measurement,** control, and transmission.

Data Sheet No. 10.15-12 Describes a **carbon monoxide detector** and its uses with Electronik potentiometer for control of C.O.

No. 7404 Describes indicating furnace **pressure controller** and its uses in measuring and controlling furnace operation.

No. 1126 Describes **pneumatic controllers,** their applications and how they work.

● **TRANSFORMERS:** Bulletin No. 135, 8 pages, contains a chart showing electrical and mechanical characteristics for distribution transformers ranging from 3 to 100 kva. Outline dimension drawings, mounting details, bushing terminal sizes, and standard low-voltage connections are included. R. E. Uptegraff Mfg. Co, Scottdale, Pa.

● **GE BULLETINS:** The following are available from General Electric Co, 1 River Rd, Schenectady 5, N. Y.

GEC-1028 The 1955 edition of **"Instrument Transformer Buyers Guide"** contains ratings, ASA accuracy classifications, and prices for indoor and outdoor potential and current transformers.

GEA-6157 Describes construction and operation of high-capacity steel-clad impulse **oil circuit breakers** in ratings of 138, 161, 230, and 330 kv.

GEA-5664C Contains descriptions of applications, installations, maintenance, design features, and accessories for **metal-clad switchgear** rated 2.4 to 13.8 kv, 50 to 500 mva.

GEA-6128 Describes ship's service **turbine-generators** for merchant marine use.

● **WELDING ELECTRODE:** Bulletin W-26 describes Manz Trode electrodes for metal-arc welding of manganese bronze and yellow brasses without preheat. Chemical composition, deposit mechanical properties, current range and welding procedure are included. Ampco Metal, Inc, 1745 S. 38 St, Milwaukee 46, Wisc.

● **CABLE TROUGH:** Bulletin 68 describes construction, dimensions, and installation of Uni-Tray Cableways and fittings for control and power cables. Delta-Star Electric Div, H. K. Porter Co, Inc, 2437 Fulton St, Chicago 12, Ill.

● **EDDY CURRENT BRAKE:** Bulletin BR-1 gives construction details, capacities, characteristic curves, and dimensions of air and liquid cooled eddy current brakes. Dynamatic Div, Eaton Mfg. Co, Kenosha, Wis.

● **PORTABLE TESTER:** Data sheet series No. 55 contains information on recommended uses, electrical ratings, component equipment and physical dimensions of portable high current test units for checking and calibrating electrically actuated protective devices. Multi-Amp Corp, 10 Third St, Newark 5, N. J.

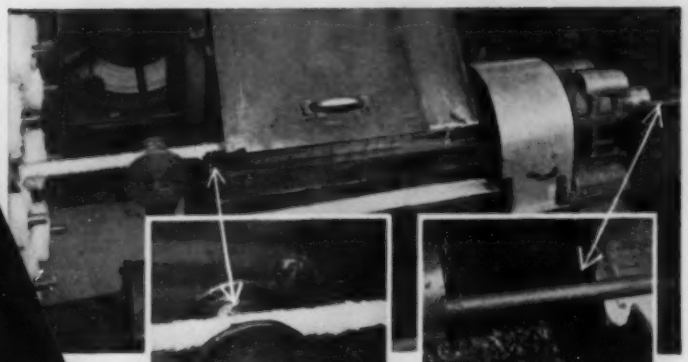
● **SUBSTATIONS:** Bulletin No. 102, 15 pages, illustrates and describes unit substations in various plant locations. High voltage section equipment, four types of transformers, and three types of low voltage switchgear are included. Dimensions, weights and operating data are given for all units. Continental Electric Equipment Co, Box 1055, Cincinnati 1, Ohio

● **TARIFFS:** A booklet entitled "Innocence Abroad, or World Trade in Ten Easy Lessons" relates the adventures of an eager young executive as he tries to sell his company's products at home and abroad. It is highlighted by cartoon illustrations. This fictitious story is based upon the experience of real companies and real people. American Tariff League, Inc, 19 W 44th St, New York 36, N. Y.

● **SILICONE PAINT:** A 6-page brochure describes a heat, rust and corrosion-resistant paint that withstands temperatures of 1600F. C. H. Dragert Co, Inc, Box 5092-L, Dallas, Tex.

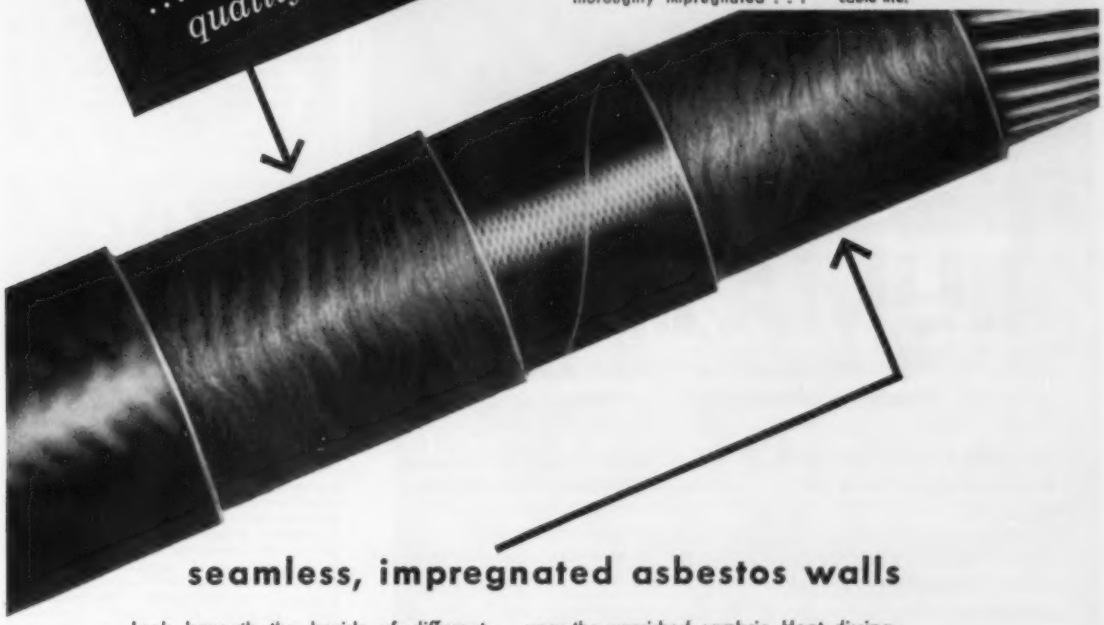
look beneath the braid

...that's where quality begins



Heavy, felted asbestos walls are applied over and under the varnished cambric tapes . . . then thoroughly impregnated . . .

then the impregnated asbestos is compressed to a dense, homogeneous wall that ensures long cable life.



seamless, impregnated asbestos walls

Look beneath the braids of different kinds of N.E.C. Type AVA wire or cable. For the longer life that means real economy, look for the seamless, felted asbestos walls of *Rockbestos A.V.C.* Type AVA.

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LUMATROL Photo-Electric Light Switch is the wisest investment you can make in *fully* automatic control of street, highway, or any other outdoor lighting installation.

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TECHNICAL LITERATURE

ASTM BOOK—"Symposium on Effect of Cyclic Heating and Stressing on Metals at Elevated Temperatures" covers the question of how changes in stress or temperature modify constant stress and temperature behavior of metals, and thus, the designs based on such behaviors. It is intended to cover those siuations involving relatively slow changes in stress or temperature or both. Price $3. American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa.

HYDRAULIC STANDARDS—"J.I.C. Hydraulic Standards for Industrial Equipment" contains all revisions made at the Jan. 1953 meetings of the Joint Industry Conference. Also included are recommended practices on hydraulic packings and seals, examples of packing code identification, sample circuit using J.I.C. symbols, and a glossary of terms. Miller Fluid Power Co, 2040 N. Hawthorne Ave, Melrose Park, Ill.

COMPRESSOR MOTOR CONTROL—Publication No. 1120, 12 pages, covers the highlights of synchronous and induction motor torque requirements and controls for centrifugal compressors. It is replete with diagrams, charts, graphs, illustrations, and formulas valuable in application problems. Electric Machinery Mfg. Co, Minneapolis 13, Minn.

EJC PROCEEDINGS—Proceedings of the General Assembly of Engineers Joint Council (Jan. 21, 1955) include panel presentations on: Nuclear engineering, employment conditions, engineering manpower, and EJC service opportunities. Engineers Joint Council, 29 W. 39th St, New York, N. Y.

SHOCK AND VIBRATION — Bulletin 804A contains a summary of shock and vibration requirements of military specifications. Each specification is listed with specific requirements, such as resonance, durability, cycling, crash safety, and performance summarized alongside. Barry Controls Inc, 1000 Pleasant St, Watertown, Mass.

CONVEYOR SYSTEMS FILM — "Movement Is Life" is the title of a 20-min 16 mm movie sponsored by the Conveyor Equipment Manufacturers Association. It depicts the scope and variety of jobs done by conveyors in actual installations. Primitive methods of handling, used in building the Pyramids, are contrasted with modern mechanized movement-automation and mechanical handling in industry, mining, warehousing and on the farm. Available from Modern Talking Picture Service, 45 Rockefeller Plaza, New York, N. Y.

LOCK WASHERS—"Spring Lock Washers and Their Engineering Principles" are discussed in a 16-page brochure now available. Tightness, thrust-bearing features, and standard specifications also are discussed. Spring Washer Institute, 74 Trinity Place, New York 6, N. Y.

FILM: PREFABRICATION OF POWER AND PROCESS PIPING—A 20 min, 16 mm, color motion picture shows up-to-date procedures and processes for shop prefabrication of pipe up to 20 in. diam with 4 in. thick walls. Mgr, Ind. Piping Div, Grinnell Co, Inc, 260 W. Exchange St, Providence 1, R. I.

ASTM DIRECTORY OF TESTING LABORATORIES—Directory is a joint project of the National Bureau of Standards and the ASTM. It gives information regarding the location of testing laboratories together with types of commodities and nature of investigations the laboratories

are prepared to undertake. Price $1 American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa.

METAL FRAMING FILM—A 16 mm color and sound movie titled, "The Sky's The Limit", tells the story of Unistrut metal framing. Through animation, the film demonstrates uses of channels, parts and fittings of the system in electrical, mechanical and materials-handling fields. Unistrut Products Co, 1013 W. Washington Blvd, Dept. MF, Chicago 7, Ill.

RUBBER—"What Every Engineer Should Know About Rubber" is an engineering handbook containing 128 pages of information about processing, properties, uses in engineering and testing of rubber and rubber compounds. Price 50¢ Natural Rubber Bureau, 1631 K St, N.W., Washington 6, D. C.

CARBIDE TOOL SELECTION—Tables suggest first choice carbide grades and secondary selections for various materials machined in metalworking plants. They include feeds, speeds, depths of cuts for average work on steels, cast iron, nonferrous, nonmetallic materials, in addition to work involving heat resistant alloys and stainless steels. General Electric Co, Carboloy Dept, Detroit 32, Mich.

FILM: WELDING LIGHT GAUGE METALS AND ALLOYS—A full color sound movie entitled "Nothing But The Best" tells the story of Heliweld, a tungsten inert-gas arcwelding process developed for rapid joining of light gauges of the so-called "hard-to-weld" metals and alloys. Animation explains in detail just how the process works and scenes shot in plants show manual, semi-automatic and completely mechanized equipment in use. Air Reduction Sales Co, 60 E. 422nd St, New York 17, N. Y.

ELECTRIC HEATING CALCULATOR—Slide calculator gives kw capacities for electric heating requirements by inserting dimensions and other specifications of a particular job. It is useful for estimating either industrial tank heating needs or comfort heating requirements of rooms. Wiegand Co, 7513 Thomas Blv'd, Pittsburgh 8, Pa.

WELDING—A report, titled "Recommended Safe Practices for Inert-Gas Metal-Arc Welding," represents the findings of a special subcommittee of the American Welding Society Committee on Safety Recommendations. It is based on laboratory studies, experience of industry to date, and an extensive review of literature and industrial records. Price 50¢. American Welding Society, 33 W. 39th St., New York 18, N. Y.

ELECTRONIC PAPERS—"Proceedings of the National Electronics Conference" (1954 Volume 10) contains 86 technical papers presented at the 1954 conference. It includes a cumulative index by subject and author of all technical papers presented during the ten year life of the conference. The papers cover electronic research, antennas, circuits, communications, computers, tubes, engineering management, instrumentation, magnetic amplifiers, components, microwave, radar and servomechanisms. Price $5. National Electronics Conference, 84 E. Randolph St, Chicago 1, Ill.

FILM: A WAY OF THINKING—A full color, 16 mm, sound, 15-min. movie shows a business paper reporter telling the story of plant modernization and how to combat obsolescence in order to maintain an adequate defense base and competitive position. Cincinnati Lathe & Tool Co, Cincinnati 9, Ohio

EEI Publication—Specification TD-5 1955 covers eyenuts and eyelets commonly used in overhead line construction. Price 10¢ Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y.

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GAI-PHONE... *the wonderful*

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Fits all standard "S" Type meters

Made from 16 gauge zinc-coated, rust resistant steel and finished in gray baked-on enamel, the KEES Socket Meter Cover is designed to prevent breakage of glass on socket meters and to insure long service in any climate. Outside diam.—8" and depth—5⅝" and over. Metal cover is also reported to minimize damage from excessive current surge due to electrical storms.

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BOOKS

Books Received Since March 25

Abstracts of the Literature of Semi-Conducting and Luminescent Materials. By Electrochemical Society-0487. Published by John Wiley & Sons, Inc. New York 16, N. Y. 159 pages, Price $5.00.

Electric Railway Engineering. By T. Ferguson. Published by Macdonald & Evans Ltd, London, England. 416 pages, illustrated. Price 37s.6d.

Servomechanisms and Regulating System Design. By Harold Chestnut and Robert W. Mayer. Published by John Wiley & Sons, Inc, New York 16, N. Y. 384 pages, illustrated. Price $8.50

Electrons, Atoms, Metals and Alloys. By William Hume-Rothery. Published by Philosophical Library, Inc, 15 E. 40th St., New York 16, N. Y. 387 pages, illustrated. Price $10.00.

Analysis of Feedback Control Systems. By Robert A. Bruns and Robert M. Saunders. Published by McGraw-Hill Book Co, New York 36, N. Y. 383 pages, illustrated. Price $7.50.

ASTM Standards on Electrical Insulating Materials. Published by the American Society for Testing Materials, Philadelphia 3, Pa. 660 pages, illustrated. Price $5.50.

Methods of Professional Engineering

Engineering Analysis. By D. W. Ver Planck and B. R. Teare, Jr. Published by John Wiley & Sons, Inc. 440 4th Ave, New York 16, N. Y. 355 pages, illustrated. Price $6.00.

Planned as an aid in teaching upper class engineering students to use basic concepts to solve typical problems, this book should also assist young graduates and technicians seeking advancement in engineering. Its basic philosophy comprises these five steps of professional logic: (1) define the problem; (2) plan the attack; (3) execute the plan; (4) check work; (5) evaluate the results.

Among its numerous examples and ilustrations are many which might stimulate an engineer in general practice to quicker solution of professional problems in several branches of engineering. To such engineers, this book should prove a useful review.

Extending Magnetic Theories

Ferromagnetic Domains. By K. H. Stewart. Published by Cambridge University Press, 32 E. 57th St., New York 22, N. Y. 184 pages, illustrated. Price $4.75.

Extension of the theories of spontaneous magnetization is the principal aim of this monograph. But because it devotes one entire chapter to magnetostriction, it becomes of interest to design and research engineers who seek to reduce noise radiation from power transformers. For such specialists, it offers possible assistance in clarifying physical relationships, and may eventually contribute to solution of this perplexing problem.

Power Systems Simplified

Electric Transmission & Distribution. Edited by Bernhardt G. A. Skrotzki. Published by McGraw-Hill Book Co, Inc, 330 W 42nd St., New York 36, N. Y. 456 pages, illustrated. Price $7.50.

Written by three engineers with varied experience in utility engineering and operation and edited by an engineering editor of long experience in electric power, this book is aimed particularly at readers who seek broad understanding of utility systems. Educational prerequisites for the reader do not exceed high school science and mathematics. The major portion of the book pertains to transmission and distribution equipment.

In utility organizations this book should assist skilled workers and technicians to understand the functioning of equipment on which they work. It might also help some engineering graduates to orient themselves in utility careers.

How AC Machines React

Transient Analysis of Alternating Current Machinery. By W. V. Lyon. Published jointly by The Technology Press of Massachusetts Institute of Technology and John Wiley & Sons, Inc, New York, 310 pages, illustrated. Price $7.00.

The book shows for the first time how the method of symmetrical components can be used to determine the transient behavior of polyphase machines under different operating conditions. Analysis of induction machines, uniform-air-gap machines, and synchronous machines operating with stationary rotors, constant, and variable speeds are presented. The author bases his analysis on the Kirchhoff differential equations for the machine and connected system.

Book should interest AC machine designers. Good working knowledge of symmetrical components and differential equations is required.

Electronic Techniques

Experiments in Electronics and Communication Engineering—2nd Edition. By E. H. Shulz, L. T. Anderson and R. M. Leger. Published by Harper & Brothers, 49 E 33rd St., New York 16, N. Y. 351 pages, illustrated. Price $6.00.

This book, as its title suggests, was written originally as a laboratory guide for college and war training programs in electronics. The new revision orients it definitely toward college use, but adds new material about oscillators, waveform control, and transistors.

But its treatment of testing equipment, component characteristics, and circuits could prove helpful to utility personnel who must acquire new knowledge to operate and service utility electronic equipment. Rapid growth of carrier and microwave systems and, more recently electronic high-speed relaying, make such skill increasingly essential.

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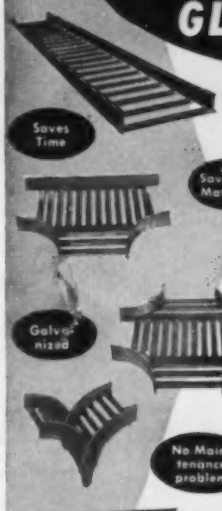
GLOBE'S CABLE WAY



A completely engineered system of cable ways, production produced and die formed for uniformity with up to twice the strength of ordinary trays, by actual laboratory tests. The universal splice plate joins all parts through the side channels only. All curved fittings are joined at the end of the radius (no tangent material is required) permitting continuous curves. This feature provides greater flexibility of application in tight places and creates an endless variety of combinations for a simple solution to any design problem of change of direction or elevation with a complete set of standard fittings.

Comes in 6", 12", 18" and 24" widths, in standard 12' lengths to further speed up installation time. Cable way can be cut to length at any point—insides and bottom always smooth—all sections punched for easy installation—perfect fit at all times. Neat, clean and uniform in appearance.

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Purposes of silver plating need not be explained to you of the electrical field.

The biggest problems of silver plating are its convenience, economy and thoroughness. "Cool-Amp" silver plating POWDER is the answer to these problems.

"Cool-Amp" deposits a genuine coat of silver that will not peel off and provides cool maximum conductivity for copper, brass or bronze contacts. It has been proven equal to any electroplating for bolted and stationary contacts and is far more adaptable . . . always ready to use.

"Cool-Amp" POWDER offers a quick and easy solution to heating due to oxidation, improves the continuity of electrical service and reduces maintenance.

"Cool-Amp" is completely harmless to the user and is simple to apply. It can be used by any number of people at the same time. ON THE JOB, in underground vaults and substations and in hard-to-get-at places. The only equipment needed is a sharp steel wire brush or abrasive cloth, clean rag and water.

Dampen a rag, dip in "Cool-Amp" and rub on surface. One pound will silver plate approximately 6,000 square inches.

$13.50 PER POUND — SHIPPED PREPAID
WRITE FOR FREE SAMPLE AND QUANTITY QUOTATIONS
GENUINE • SIMPLE SILVER PLATING
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How to spend less for expendables

Day after day, week after week, your instruments steadily use up charts, inks, thermocouple wires, tubes, wells—all the expendable accessories that require regular replacement.

If you've been buying your supplies on a hand-to-mouth basis, you're missing out on some sizable savings. Honeywell has developed a modern purchasing plan that gives you new economy, convenience, and quality. This new plan provides assistance in selecting the right supplies and sets up a custom-fitted schedule for buying that will cut your inventories, simplify your purchasing, and save you a big percentage of your annual bill.

New HSM Plan

Foundation of this new plan is your Honeywell Supplies Man. He is trained in the Honeywell factory and has a broad and thorough knowledge of instrumentation. A full-time supplies specialist, your HSM gives you personalized, expert service.

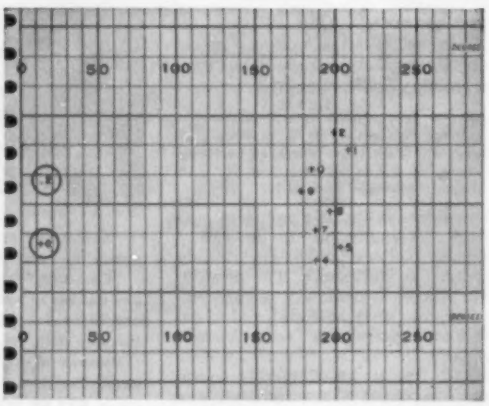
These men are strategically stationed throughout the country to serve you. They will help you plan your purchases to get maximum quantity discounts . . . keep your inventories balanced and always up to date.

Here's how the plan works

1. ***Survey plant***—Your Honeywell Supplies Man checks annual consumption of each supply item in your plant and establishes minimum inventory needs.
2. ***Detail requirements***—He then shows you what you can expect to purchase during the coming year to keep adequate stocks on your shelves.
3. ***Assist in selection***—He keeps you up to date on newest developments, and recommends specific types of equipment wherever your present buying can be improved.
4. ***Estimate savings***—Next, he prepares a blanket annual order, grouping like items to get the biggest quantity discount. Savings may run as high as 50%.
5. ***Schedule deliveries***—Finally, he arranges a regular delivery schedule that assures that you will always have adequate supplies on hand.

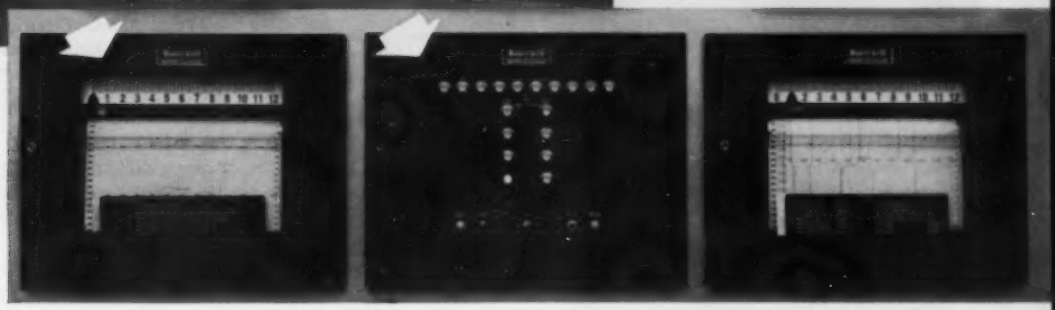
Give your Honeywell Supplies Man a call. He's at your local Honeywell office . . . as near as your phone.

Boiler tubes protected against overheating by



The Scanning System can monitor up to 270 temperature points. Sample of chart shows how all these points are recorded clearly. Number of the bank is printed at left, while a numbered "+" identifies the temperature of the point in the bank.

General view of Pennsylvania Power & Light Co.'s Martins Creek Station. Inset shows a section of the boiler board on which are mounted (arrows) the **ElectroniK** *System for scanning boiler tube temperatures. Instrument at the right is a multipoint* **ElectroniK** *instrument for recording air, flue gas, feedwater and steam temperatures.*



ElectroniK scanning system

BOTH during start-up periods and during normal operation, boiler tube temperatures need watching . . . as a means of guarding against dangerous temperature stresses and possible rupture. The large number of points that require attention, however, makes this an expensive job for conventional recording instruments. With the *ElectroniK* Scanning System, this important task can be done at exceptionally low cost per point. Furthermore, temperature data from *all* boiler tubes can be centralized on a single instrument.

As an example of how this versatile temperature scanning system works in a power plant, take a look at the installation picture above at the new Martins Creek Station of Pennsylvania Power & Light Company . . . an outdoor design, engineered by Ebasco Services Incorporated. Mounted on the boiler control panel is the Scanning System, consisting of an *ElectroniK* recorder and its switching unit.

Thermocouples at selected tubes in the several superheaters are connected to the Scanner in six banks of nine points each. The instrument automatically scans through the entire series of points. If any exceed a preset limit, the instrument instantly starts to record those dangerous spots . . . and at the same time operates an annunciator. At the flip of a switch, the operator can stop the automatic scanning and focus attention on individual banks or individual points in a bank.

This centralized system keeps operators fully informed on boiler tube temperatures . . . helps in reducing maintenance and speeds the start-up operation. Similar instrumentation can also be applied to monitoring temperatures of turbine bearings, pumps, hydraulic couplings and other vital locations.

For a discussion of how this and other Honeywell instrumentation can be applied advantageously to your station, call your local Honeywell sales engineer . . . he's as near as your phone.

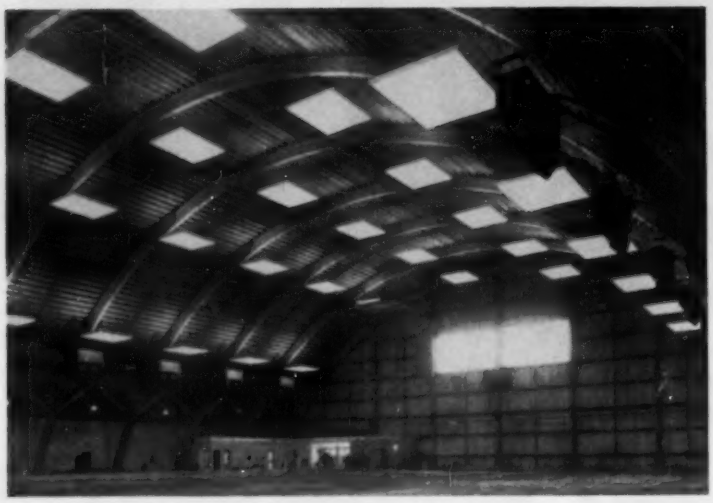
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

● **REFERENCE DATA:** Write for Data Sheet 10.0-9, "*ElectroniK* Scanning System". . . and for Catalog 9050, "Instrumentation for Steam Power Plants."

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS

First in Controls

MANUFACTURERS AND MARKETS



Fluorescents Economical at 400 Cycles

A new, efficient general lighting system, seen as a forerunner of many large industrial, commercial and institutional lighting installations, was unveiled May 1 at Union College, Schenectady, N. Y. Installed in the College's nearly completed Alumni Memorial Field House, the system is reported to be the first application of high-frequency fluorescent lamp operation for general lighting of a large area.

Designed and developed by the General Electric Co, the system calls for the operation of 490 eight-foot-long slimline lamps on 400-cycle power. Increasing the frequency from 60 cycles is accomplished by two 30-kw rotating-type frequency converters. Lamps are operated at 22% over their 60-cycle wattage rating.

Primary power source for the system is 208 v, 3 phase, 60 cycles, and the secondary is 600 v, 3 phase, 400 cycles, connected to be 300 v to ground.

A simplified wiring system reduces the number of circuits from 84, for the lighting originally considered, to 14 for the 400-cycle design.

Chief benefit of the system is that it represents the most economical method yet devised for obtaining higher levels of light in highbay areas, according to John H. Campbell, GE illuminating engineer who conceived and developed the technique.

The system cost about 10% less to install than an incandescent-mercury system originally considered for the field house. In addition, the 400-cycle system offers an estimated 50% savings in annual operation and maintenance costs while producing 20% higher levels of light.

The problem at the field house was to illuminate 44,000 sq ft of floor area to a maintained light level of 45 ft-c. Fluorescents were considered desirable in order to avoid the relatively higher brightness inherent in the above system. High-frequency made fluorescents practicable for this installation because each fixture weighs 110 lb less and wiring costs are lower. Curtis Lighting made the 35 fixtures.

Westinghouse Control Has No Moving Parts

Westinghouse Electric Corp has developed a control system without moving parts for industrial applications. Cypak systems, as they are called, consist of circuitry built around magnetic amplifiers and transistors, which are said to be "ultra-reliable" because of their lack of moving parts. Systems can be built that exceed a 20-million cycle limit in a matter of hours or days without deteriorating.

A director systems department has been established to engineer, build and sell the systems, according to John K. Hodnette, Westinghouse vice president. It will be managed by L. W. Golden and will be located in the Pittsburgh area.

First Quarter Sales: A-C, GE, Westinghouse

Sales for the first quarter of 1955 are reported according to information received up to press time.

Allis-Chalmers Mfg Co — Sales amounted to $126,379,016. For the like 1954 period, amounted to $123,617,280. Unfilled orders as of March 31, 1955 amounted to $136 million as compared with $173 million as of same date in 1954.

General Electric Co — Sales amounted to $765,907,000. This is within 2% of the all-time sales record established in the first 1953 quarter, and an increase of 7% over the first quarter of 1954.

Westinghouse Electric Corp—During January and February the company booked "more orders for heavy power equipment than in all of last year, but at lower prices." Budget forecasts called for net sales billed "approaching the record established in 1954, and new orders received probably will exceed last year's mark by more than 10%."

U. S. Aluminum Production

Primary aluminum production in the United States, according to the Aluminum Association, for March was 130,272 tons, up from 116,236 tons in February and from 122,339 tons in March, 1954. Total for the year through March was 374,711 tons, an increase of 65,643 tons for the corresponding 1954 period. All-time record productions were established in March and in the first 1955 quarter.

Copper Production Up

U. S. primary copper production for March was 98,908 tons, up from 89,078 tons in February, according to the Copper Institute. Refined copper production was 134,933 tons in March, an increase from 123,162 tons in February. Deliveries to fabricators were 130,586 tons, up about 22,000 tons from 108,503 tons in February. Refined stocks at the end of March were reported as 46,091 tons, an increase from 44,579 tons in February.

(*More M & M on page* 144)

Installation photographs courtesy of Berko Electric Manufacturing Corp.

You can recommend this radiant heat panel confidently

The wall-mounted heating units illustrated above are made and sold by the Berko Electric Manufacturing Corp., Queens Village, N. Y. Owners of such Berko heaters are enthusiastic about the comfort, convenience and safety they provide.

The heating elements in these heaters are PYREX Radiant Glass Panels. You can expect your customers to have confidence in any heater you may recommend with a PYREX panel heating element, as they are already familiar with other PYREX brand products having excellent heat-resistant qualities.

PYREX Radiant Panels are made of heat-resistive glass with an electrically conductive coating inseparably bonded to the entire back surface. Thin silver strips bonded to opposite edges of the panel distribute the current *evenly* over its entire length and breadth. This provides completely uniform heat radiation.

Efficient

PYREX Radiant Panels radiate about double the heat of a metal-finish radiator at the same operating temperature. This high degree of efficiency helps bring the cost of electric heat within reach of more homeowners. Also, there is little initial surge of current when these panels are turned on—another point of economy.

The coated side of the panel itself acts as a heat reflector. With the addition of a metal reflector, as much as 80% of the input energy is available as heat radiation from the panel's uncoated side.

At 400°F. over 75% of the panel's heat energy is emitted in wave lengths of four microns and longer. This energy provides instant warmth and comfort.

Customer benefits

PYREX panels provide clean, draftless heat and the panels themselves are easy to wipe clean. Free dust particles will not adhere to or carbonize on them. In-the-wall installation leaves completely free floor space and installation is easy. There's space saved, too, because there is no heating room. Every room is individually thermostatically controlled. The glass is high in physical strength. It's safe and durable.

For additional technical information on PYREX Radiant Panels, write, wire or phone.

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Corning means research in Glass

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Pole Topper

A new mastic compound containing penta, formulated by the Osmose Laboratories to PROTECT THE ROOF of standing poles.

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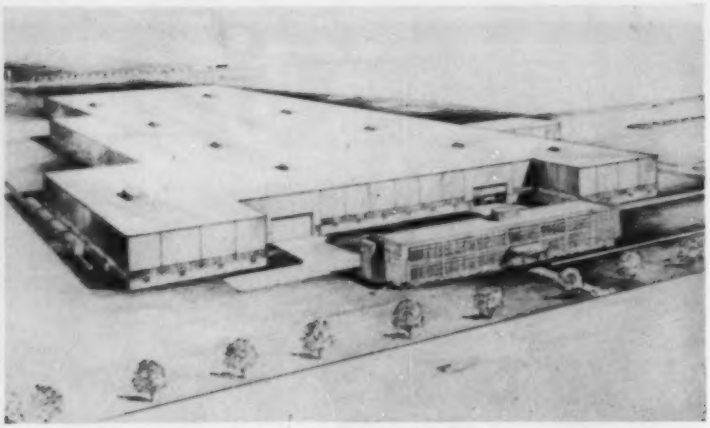


American Brass to Start Western Mill

A $13 million brass mill in Los Angeles County, Calif, will soon be under construction by The American Brass Co, John A. Coe, Jr., president of the Waterbury, Conn, firm announced. The new mill will be built for the production of copper and copper-base alloys in the form of sheet, strip, rod, tubing and drawn copper products. Annual capacity is estimated at 30 million pounds. When in full operation, the mill will furnish employment for about 500 persons.

The new plant will be located on a 45-acre site, be one-story construction, have some 330,000 sq ft of floor area, and be equipped with overhead crane service throughout.

C. Russell Epley has been named manager of this new facility. He was San Francisco district sales manager.

STRENGTH, ENDURANCE that Meet the Test!

Crapo
Guy and Messenger Strand

IN THE FIELD as in laboratory tests . . . *Crapo* Galvanized Steel Strand proves itself capable of withstanding severe punishment. Steel's inherent strength and durability are combined with definite economies in every size and grade of *Crapo* Steel Strand. You'll find the heavy, ductile, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide lasting protection against corrosion.

Contact your jobber of *Crapo* Galvanized Products or write direct for further information!

INDIANA
STEEL & WIRE COMPANY
MUNCIE, INDIANA

Honeywell, Raytheon Set Up Computer Company

Minneapolis-Honeywell Regulator Co of Minneapolis, Minn., and Raytheon Mfg Co of Waltham, Mass., have formed a jointly-owned corporation, to be known as Datamatic Corporation, to engineer and market new, large, highspeed electronic data-processing systems for use in business and government. Honeywell will have a 60% and Raytheon a 40% interest in the new company. The firm, to be headquartered in Waltham, Mass., will have its own administrative officers and directors.

Brown Boveri Awarded N.Y. Transformer Contract

Brown Boveri Corp of New York was awarded a contract for thirteen transformers by the Power Authority of the State of New York for its St. Lawrence River project. The bid price was $1,541,480.

When the transformer bids were opened, the apparent low bidder was Allis-Chalmers Manufacturing Co. It later developed that the Allis-Chalmers bid was informal and, as a result, the Authority approved award to Brown Boveri Corp.

With this award, commitments have been made for the major electrical generating equipment. The turbines costing $10,138,000 were awarded to Allis-Chalmers and Baldwin-Lima, while the sixteen generators costing $14 million were awarded to General Electric Co.

Bell Lab Develops Miniature "Brain"

Bell Telephone Laboratories of New York has developed a miniature electronic "brain", known as TRADIC, TRAnsistor-DIgital Computer. This device is believed to be the first all-transistor computer designed that will probably occupy less than 3 cu ft. Its immediate application is for the U. S. Air Force.

The "brain" contains nearly 800 transistors. It also contains nearly 11,000 germanium diodes which serve

as the electronic equivalent of tiny one-way switches.

TRADIC can do 60,000 additions or subtractions, or 3,000 multiplications or divisions a second. A typical problem fed into the machine requires it to go through about 250 steps of computation. It can run through an entire problem of that complexity and provide an answer in about 15 thousands of a second. As many as thirteen 16-digit numbers can be handled simultaneously.

MANUFACTURING BRIEFS

Johns-Manville Corp expects to complete its synthetic silicates plant at Lompac, Calif., diatomite mine in early 1956. Also, the first half of the "largest asbestos mill in the world" has been completed at the company's Jeffrey Mine, Asbestos, Quebec, and the entire mill should be finished in 1956. Improvements are being made to existing Transite asbestos-cement pipe machines for a one-third increase in capacity.

Essex Wire Corp of Fort Wayne, Ind., has acquired the physical assets of J. M. White, Inc of Philadelphia, Pa. Present plans are to operate the facility as the J. M. White Division, Essex Wire Corp.

Tensolite Insulated Wire Co, Inc of Tarrytown, N. Y., doubled its production capacity with the completion of new plant additions. Usable plant area has been increased to 25,000 sq ft.

Cleveland Crane & Engineering Co of Wickliff, Ohio, recently started excavation for a $300,000 air-conditioned engineering building. The brick structure will be 128 x 71 ft with a second floor section at rear measuring 25 x 138 ft. Cleveland Crane is a subsidiary of McNeil Machine & Engineering Co.

Electric Machinery Mfg Co of Minneapolis, Minn., has furnished two 3,400-kw, 4,160-v generators, each driven by a Baldwin-Lima-Hamilton Corp 9-cylinder, 257-rpm, 2-cycle, 4,800-bhp engine. The installation is at the Great Bend, Kan., plant of the Central Kansas Electric Cooperative Association, Inc. These units boost the plant generating capacity to 10,520 kw, all installed since 1947.

SALES ASSIGNMENTS

COMPANY STAFFS

A. B. Chance Co has named J. S. Curtwright, with the company for 16 years, as director of Centralia, Mo., sales service office and the field sales force. His title will be sales manager of electrical wholesaler products, responsible for sale and distribution of products through electrical wholesalers.

BullDog Electric Products Co has assigned Gordon J. McCormick, who recently completed the company's field engineering program, to its Boston District office. Formerly, McCormick was associated with Minneapolis-Honeywell Regulator Co and the Security Companies.

Westinghouse Electric Corp has announced the following sales personnel changes in the field: T. P. Jones, until recently Philadelphia District manager, was named assistant manager of the company's Atlantic Region; T. E. Stieber, formerly electric utility regional manager, succeeds Jones; and Robert N. Anderson, with the company 27 years, has became electric utility manager of the Atlantic Region. Westinghouse also announced that its Salt Lake City apparatus territory has been designated the Intermountain District of the company. H. B. Hodgins, branch manager of the territory since 1949, was named manager of the new district. His headquarters will remain the same.

Allis-Chalmers Manufacturing Co has made R. H. Godeke manager of a new General Machinery Division branch office in the Medical-Professional Building in Corpus Christi, Tex. Godeke had been a representative in A-C's San Antonio District office since 1947.

Beaver Pipe Tools, Inc, has appointed Ned Dengler as District manager of sales with headquarters in Warren, Ohio, and covering southern Ohio, Indiana, West Virginia, and Kentucky. Formerly, Dengler was associated with Bingham-Herbrand Corp.

Kerite Co has named Robert A. Young, a manufacturers' representative for the company since 1946, as Pacific Coast manager to supervise sales and engineering for Kerite's power, railroad, and industrial customers on the coast and in adjoining states. Young will continue to operate his own business as well.

REPRESENTATIVES

Standard Transformer Co has appointed John H. Ormond, 2519 7th Ave, Oakland, Calif., as its representative in southern Oregon, northern Nevada, and northern California.

New Virginia Steam Plant

Excavation work for a new 225,000-kw steam generating unit at Appalachian Electric Power Co's Glen Lyn plant in Giles County, Va., has been started. The utility estimates that the unit, to be completed in 1956, will cost about $26.4 million.

Eliminate
GUY GUARD TROUBLES
this easy
Flexibal
way
1 SLIP OVER WIRE
2 DRIVE HOME NAIL
3 ATTACH CLAMP
"the Economical Guard that can't go wrong"
R.E.A. APPROVED
COSTS 1/3 LESS THAN METAL GUARDS AND NO MAINTENANCE PROBLEM
FLEXIBAL Guy Guards provide the flexibility that yields with the blow and cushions the impact. Aluminum-painted, they increase the day and night visibility. Easiest guard to handle, simplest and quickest to install—by all odds safest in use, with a proven record of greatly reduced losses. Specify it for better appearance, greater convenience, and major savings.
Used and Praised by Constantly Growing List of Utilities
Write for Free Sample and Prices
IMMEDIATE DELIVERY
TEN COMPLETE SETS IN THIS ONE LIGHT EASY TO HANDLE CARTON
SEE YOUR JOBBER OR WRITE TO
S. E. OVERTON COMPANY
SOUTH HAVEN, MICHIGAN

NEWS ABOUT PEOPLE

PGE Elects Warren New President

F. M. WARREN

Portland General Electric Co has elected Executive Vice Pres Frank M. Warren, Jr, as the utility's new president and Thomas W. Delzell, chairman of the board, as executive head. Warren replaces James H. Polhemus, who announced his retirement after 15 years as president.

After finishing Harvard Graduate School of Business in 1937, Warren joined PGE to conduct statistical studies. He was made assistant to the retiring president three years later. And in 1942 he was elected a vice president; in 1947, executive vice president.

T. W. DELZELL

Delzell has been associated with PGE as chairman of the board since reorganization of its predecessor company, Portland Electric Power Co, in 1948. As independent trustee of PEPCo for nine years, Delzell authored the reorganization plan adopted. In 1938 and 1939, he was assistant public utilities commissioner of Oregon.

Polhemus, general manager of the Port of Portland for two years, joined PEPCo as executive vice president in 1936. During reorganization proceedings he moved up as PGE president in 1940.

Top-Level Executives Named for NIPSCo

E. D. Anderson, first vice president, has been elected executive vice president of Northern Indiana Public Service Co. And Rollin M. Schahfer, chief engineer, and James C. Sackman, general sales manager, have been elected as vice presidents in charge of engineering and electric operations and of sales, respectively. The new vice presidential posts were created as a result of increased company expansion and development over recent years.

E. D. ANDERSON

All three of the new officers joined NIPSCo in 1924 as cadet engineers.

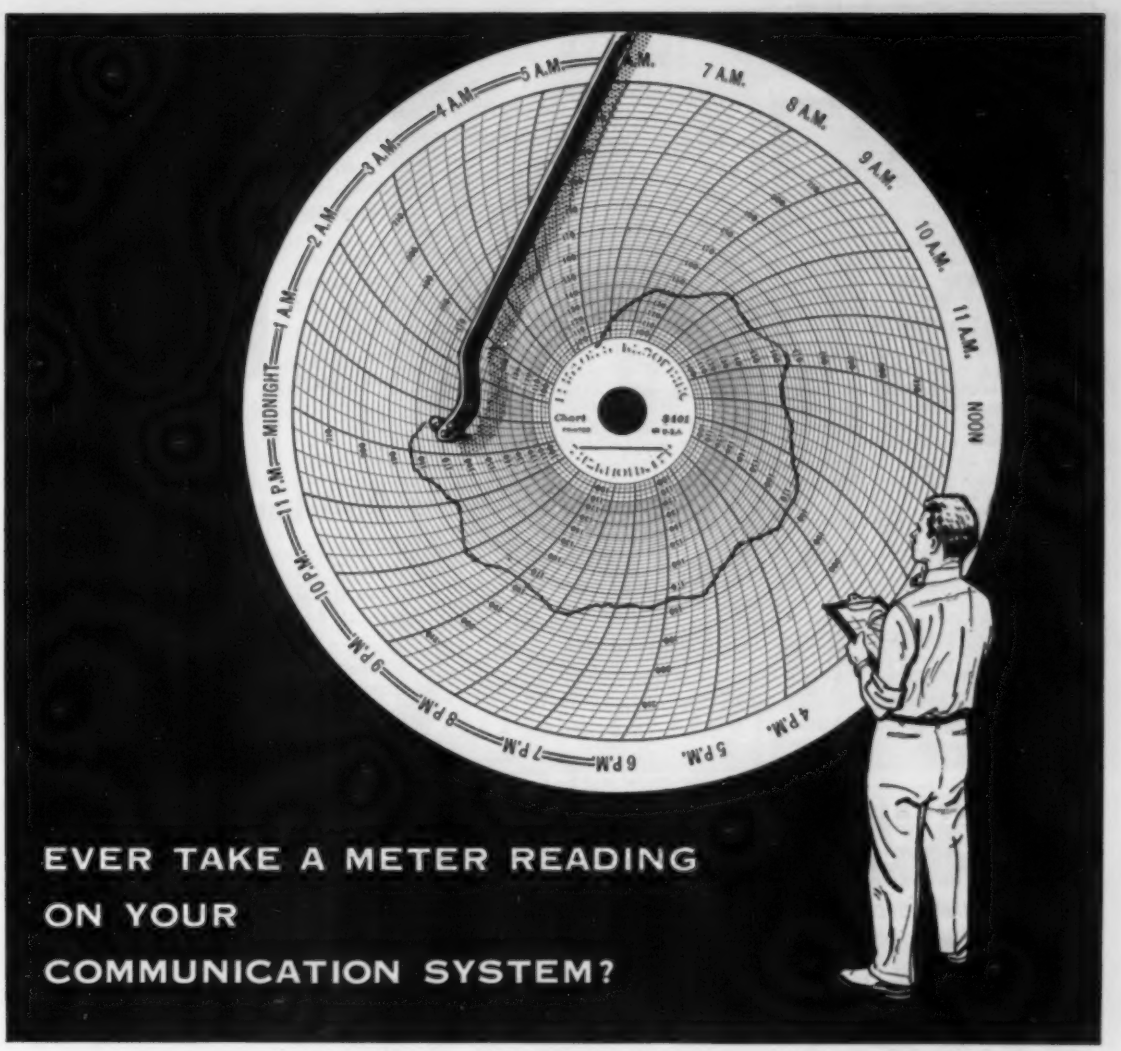
The new executive vice president, before his election as a vice president in 1938, served as mechanical engineering assistant, gas engineer, district manager, division manager, and general service manager. In 1949 he was elected president of the Indiana Electric Association.

Schahfer has been superintendent of electric transmission department, district manager, mechanical and electrical engineer in the general engineering department, and chief engineer of the company. Prior to his appointment as general sales manager in 1935, Sackman served in various sales department posts.

(*More News About People on page* 148)

R. M. SCHAHFER

J. C. SACKMAN



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Bell System communication engineers will help you take a good, close look at your communication system . . . *at no cost to you.*

Your Bell Telephone Company will make a comprehensive survey to help you get the best use of your facilities . . . local exchange, long distance, mobile, teletypewriter, metering and supervisory control . . . all the communications you use.

These surveys include recommendations to give your operation the best communications at the lowest possible costs. Many companies have changed, rearranged or added services or facilities on the basis of these surveys.

• If you are interested in a Bell System communication survey without charge, call your local Bell Telephone representative now.

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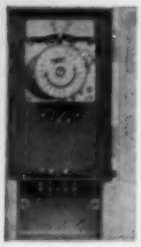
SAUTER
TIME SWITCHES



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SAUTER TIME SWITCHES are preferred for precision, perfect automatic operation, lower maintenance costs, and performance perfection even under the most adverse weather conditions.

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The quality of Ankoseal is insured by rigid controls during manufacture. The results are high dielectric strength, dependability, long service life and quality service at low cost. Made for aerial, duct and direct burial installations. *Write for information on specific installation requirements.*

THE ANSONIA WIRE & CABLE COMPANY
ANSONIA, CONNECTICUT

Renwick Advanced to VP

Southern California Edison Co has announced the election of Bruce Renwick, general counsel of the utility, as a vice president.

Renwick left his private law practice in Los Angeles to become assistant counsel of the Edison organization in 1942. Six years later he was advanced to the post of general counsel in the company.

Previous to entering private law practice, the new vice president had taken a law degree from Stanford Law School in 1928 and had been associated with the Los Angeles law firm of Farrand & Slosson. At present, Renwick is a member of Edison Electric Institute's legal committee.

B. RENWICK

DeBellis Wins 1954 Lamme Medal

Aldo M. deBellis, assistant electrical engineer with Consolidated Edison Co of New York, Inc, has been awarded the 1954 Lamme Medal by the American Institute of Electrical Engineers.

The award honors deBellis "for his contributions to the design and development of power station equipment, especially air insulated, phase isolated, metal-clad high voltage bus structures, and disconnecting switches." The medal will be presented at AIEE's summer meeting set for Swampscott, Mass., June 27-July 1. DeBellis has been engaged in electrical design for generating stations for 35 years.

A. M. deBELLIS

PERSONAL BRIEFS

Concord Electric, AIEE

Robert A. Ferreira, with Concord Electric Co since 1935, has been appointed manager of the utility . . . **A. P. Fugill,** chief electrical engineer of Detroit Edison Co's planning and project engineering department, has been named a fellow of American Institute of Electrical Engineers. The honor recognizes his contributions to power system design for a large utility during periods of rapidly increasing load demands in the Detroit area.

Wisconsin Public Service Corp

D. E. Goggin has been named head of the rates and research department of Wisconsin Public Service Corp. He succeeds Harry I. Miller who was recently elected a vice president of the company (EW, March 28, p 36). Goggin joined Public Service in 1923 in the Milwaukee office. He was transferred to Oshkosh as rates and research assistant in 1944.

Municipal Groups Elect

California Municipal Utilities Association in Sacramento has elected **Carl L. Richey,** of Sacramento Municipal Utility District, president, and **Paul Beermann,** of San Diego Water Department, vice president . . . **J. W. Andersen,** general manager of Muscatine Municipal Water & Electric Plant, has been elected president of the Iowa Association of Municipal Utilities.

PERSONAL BRIEFS

Federal Power Commission has announced the appointment of **Louis Zanoff,** FPC member since 1935, as an assistant chief of bureau of rates and gas certificates. He succeeds **Edgar S. Coffman** who recently became regional engineer at the commission's Fort Worth office.

John F. Haines, formerly vice president and chief engineer of McCauley Industrial Corp, has joined American Locomotive Co as chief development engineer of atomic products.

Nicholas J. Lesselyoung has been appointed a member of the Public Service Commission in Wisconsin, succeeding **W. F. Whitney** whose term expired March 7. Whitney will continue his duties as president of the commission until year-end to finish work on pending cases.

John P. Buehler, retired U. S. Army colonel with the Corps of Engineers and one-time Seattle District engineer, has joined Bechtel Corp as an executive engineer. He will be attached to the company's Power Division headquarters in San Francisco on special studies and assignments.

Leeds & Northrup Co has named **Alfred E. Tarr,** former manager of the company's Sales Engineering Division, as assistant to the president of the company.

Westinghouse Electric Corp has named **M. E. Fagan, Jr,** who joined the company in 1946, as manager of the Transformer Division's ordnance department, recently created as a separate administrative unit in the division. For the Gearing Division's new hydraulic drives department, an outgrowth of Schneider Manufacturing Corp, a recently dissolved subsidiary, Westinghouse has appointed **S. M. Johns** as sales manager; **T. P. Dunkin,** manager of manufacturing; and **P. L. Fosburg,** engineering manager.

Kuhlman Electric Co has appointed **Dr William T. Sackett, Jr,** manager of research. Previously, Dr Sackett spent five years as a senior engineer and assistant chief of the Electrical Engineering Division of the Battelle Memorial Institute, located in Columbus, Ohio.

the Remarkable

Anco LOCK NUT

- cannot be loosened by vibration
- only ONE nut necessary
- easier to install

Galvanized ANCO NUTS save time and money in installation . . . offer unusual strength and dependability. They're practically standard equipment for power line clamps, cross-arm braces, insulators . . . radio and TV transmission towers.

Only one nut is necessary for a permanent connection . . . the nut and lock are a *single unit*. Galvanized ANCO NUTS require no special tools . . . they're easily installed—or removed—by unskilled labor with any ordinary wrench. And galvanized ANCO NUTS provide top-notch performance . . . threads cannot be stripped . . . the locked nut cannot slip . . . *vibration tends only to tighten an ANCO NUT.*

Investigate the Galvanized ANCO NUT today . . . you'll find it's the best answer to your fastening problem.

ANCO LOCK NUTS are made in all standard sizes, either black or galvanized, with standard U. S. or SAE thread. Also available in brass, bronze, aluminum, stainless steel, etc.

Write for samples, complete information, and prices.

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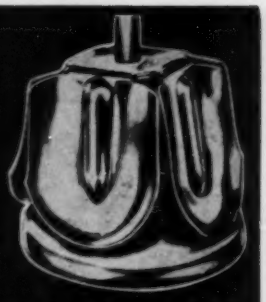

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CERTIFIED QUALITY...
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WHAT'S NEW?

We're interested . . . and so are Electrical World's readers! Are you all steamed up about your new product, new plant or expanded facilities? Got some red-hot new literature, research results or a new production method? Any financial, product design changes —shifts in executive personnel—consolidations? Whatever you have, *World* makes it easy to bring it to the reader's attention. Write for the booklet . . . *"How To Get Maximum Value Out of The News Releases You Write For Electrical World."*

MEETINGS CALENDAR

An extended list of coming meetings appears in the last issue of each month.

MAY

ILLUMINATING ENGINEERING SOCIETY—Midwestern Regional Conference, Edgewater Beach Hotel, Chicago, May 2-3; Canadian Region, Mount Royal Hotel, Montreal, May 12-13; East Central Region, Abraham Lincoln Hotel, Reading, Pa. May 19-20.

RURAL ELECTRIFICATION ADMINISTRATION—6th Annual Operations & Maintenance, Conference, Shirley-Savoy Hotel, Denver, May 2-5.

EDISON ELECTRIC INSTITUTE—Transmission and Distribution Committee, Statler Hotel, Detroit, May 3-4; Spring Meeting, Purchasing and Stores, Dinkler Tutwiler Hotel, Birmingham, Ala., May 8-11; Prime Movers Committee, Biltmore Hotel, Los Angeles, May 9-10; Accident Prevention Committee, Pfister Hotel, Milwaukee, Wis., May 9-10; Commercial Electric Cooking Conference, Sheraton Hotel, Chicago, May 10; Electrical Equipment Committee, Rice Hotel, Houston, Tex., May 16-17; Industrial Relations Committee jointly with Personnel Administration Section, Southeastern Electric Exchange, Netherlands Plaza Hotel, Cincinnati, May 19-20; Dealer Coordination Workshop, Webster Hall Hotel, Pittsburgh, Pa., May 19-20.

AMERICAN PUBLIC POWER ASSOCIATION—Annual Meeting, Jacksonville, May 3-5.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Middle Eastern District No. 2, Columbus, May 4-6; Electric Heating Conference, La Salle Hotel, Chicago, May 10-11.

NATIONAL ASSOCIATION OF ELECTRIC COMPANIES—Annual Meeting, Mayflower Hotel, Washington, D. C., May 5.

WISCONSIN UTILITIES ASSOCIATION—Home Service Conference, Edgewater Hotel, Madison, May 5-6.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION—Business Development Section, Hotel Utah, Salt Lake City, May 9-11.

ELECTRIC COMPANIES ADVERTISING PROGRAM—Copy Group, Hotel Sheraton, Chicago, May 10.

PACIFIC COAST ELECTRICAL ASSOCIATION—Annual Convention, Palace Hotel, San Francisco, May 11-13.

PUBLIC UTILITIES ADVERTISING ASSOCIATION—34th Convention, Sheraton Hotel, Chicago, May 11-13.

PENNSYLVANIA ELECTRIC ASSOCIATION—Spring Meeting, Transmission and Distribu-

tion Committee, Irem Temple Country Club, Dallas, Pa., May 5-6; Spring Meeting, Hydraulic Power Committee, Hotel Sheraton-Brock, Niagara Falls, Ont., May 5-7; Spring Meeting, Systems Operation Committee, Skytop Lodge, Skytop, Pa., May 12-13; Spring Meeting, Electrical Equipment Committee, Hotel Roosevelt, Pittsburgh, May 19-20; 1955 Annual Industrial Sales Conference, Bedford Springs Hotel, Bedford, Pa., May 19-20; Annual Accounting Conference, William Penn Hotel, Pittsburgh, May 23-24; Spring Meeting, Relay Committee, Abraham Lincoln Hotel, Reading, Pa., May 26-27.

NEW YORK STATE SOCIETY OF PROFESSIONAL ENGINEERS—Annual Convention, Commodore Hotel, New York City, May 12-14.

NORTHWEST PUBLIC POWER ASSOCIATION—Engineering and Operations Section, Monticello Hotel, Longview, Washington, May 19-20.

INTERSTATE POWER CLUB—General Electric Co Wire and Cable Plant, Bridgeport, Conn., May 20.

NATIONAL ASSOCIATION OF ELECTRICAL DISTRIBUTORS—47th Annual Convention, Conrad Hilton Hotel, Chicago, Ill., May 22-25.

NORTH CENTRAL ELECTRICAL ASSOCIATION—Accounting Committee, Fergus Falls, Minn., May 27-28.

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AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Oil and Gas Power Conference, Statler Hotel, Washington, D. C., June 5-10.

AMERICAN WELDING SOCIETY—Spring Meeting and Welding Show, Hotel Muehlebach, Kansas City, Mo., June 7-10.

ILLUMINATING ENGINEERING SOCIETY—Northeastern Regional Conference, Ft. William Henry Hotel, Lake George, N. Y., June 10-11.

ELECTRIC COMPANIES ADVERTISING PROGRAM—Management Group, Statler Hotel, Los Angeles, Calif., June 12.

EDISON ELECTRIC INSTITUTE—23rd Annual Convention, Los Angeles, Calif., June 13-16.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Magnetics Conference, Hotel William Penn, Pittsburgh, June 14-16; Summer General Meeting, New Ocean House, Swampscott, Mass., June 27-July 1.

AMERICAN SOCIETY FOR ENGINEERING EDUCATION—63rd Annual Meeting, Pennsylvania State University, State College, Pa., June 20-24.

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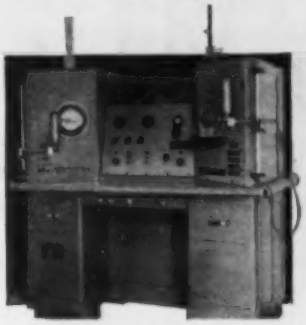

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FINANCIAL AID TO HIGHER EDUCATION

Business Help for Our Colleges A Job for All Business Firms

IN recent months, individual business firms have announced the adoption of a variety of plans, both imposing and ingenious, for financial aid to higher education in the United States. In doing so, they have taken a lead in dealing with a problem of transcendent importance both to the business community and to our nation as a whole.

Previous editorials in this special series have shown that:

1. Our colleges and universities, and particularly the independent, privately endowed institutions, are in grave financial difficulties.

2. These difficulties promise to become much more acute in the years immediately ahead unless extraordinary steps are taken to relieve them.

3. A financially crippled system of higher education is a major national menace.

If, however, the business community is to play an adequate part in helping our colleges and universities financially, the plans adopted by business firms thus far constitute merely a beginning and a set of guide posts. What is required is a general movement on the part of business firms to go to the financial aid of higher education. Such a movement would involve a myriad of individual company plans which, in the nature of the case, cannot be expected to bring great renown or publicity to their sponsors.

Rescue Operation Is Feasible

For the business community as a whole it is feasible to make a major and possibly a decisive contribution to putting our colleges and universities back on their feet financially. One percent of business profits before taxes would do it. In 1954 business profits before taxes were about $35 billion. If one percent of these profits, or $350 million, were contributed to our independent, privately endowed colleges and universities it would enable these institutions (1) to increase the salaries they pay by $200 million a year, and (2) to provide $150 million more for modernization and maintenance of their establishments. In the opinion of competent authorities, this would put these institutions in relatively good working order financially, a process to which a matching grant of $50 million by the Ford Foundation for the improvement of faculty salaries will make a large contribution. It would add about one-fourth to their present annual outlay of about $1.4 billion.

Such a contribution from business would not meet the needs of the independent institutions for new buildings and equipment required to accommodate the great increase in college enrollment anticipated in the years immediately ahead. Neither would it relieve the financial problems of our tax-supported colleges and universities. As a group these institutions have fared better financially in recent years than the

independent institutions. But they also face grave financial problems, particularly in the provision of adequate faculty salaries. It would be far simpler, however, to solve the financial problems of the tax-supported institutions if the independent colleges and universities were back on their feet financially.

One Dollar Does Work of Two

The federal government exempts 5 percent of business profits from the tax imposed upon them if the 5 percent is devoted to religious, charitable or educational purposes. (Most profits are taxed 52 percent.) A contribution of one percent of business profits to higher educational institutions would exhaust only one-fifth of this allowance. It would bring to about two percent the total share of business profits going to both educational and charitable purposes.

In 1953, business firms contributed about $400 million, or slightly more than one percent of profits before taxes to educational and charitable purposes of all kinds. Of this total about $75 million went to educational institutions, mostly colleges and universities.

For some companies it is feasible to contribute more than the average contributed by business generally. Indeed, some companies not only utilize their full 5 percent of tax-deductible funds for charitable and educational purposes but go beyond it. For other companies in financial difficulties no contribution at all is possible.

If, however, those business firms for which it is financially feasible contributed one percent of their profits before taxes to our colleges and universities, the problem of adequate support for the crucially important business of higher education would be far along the way to successful solution. **In 1954 a contribution of one percent of their profits before taxes, or about $350 million, would have reduced business profits after taxes by only about half that amount. This would have meant a reduction of about $175 million, out of a total of about $17.8 billion of profits after taxes.**

Attractive plans to channel financial aid from business to higher education have been abundantly demonstrated recently. These plans, for the most part the creation of large corporations, have included not only a broad array of scholarship grants, but such ingenious arrangements as that by which a company matches with its funds the gifts its employees make to the colleges of which they are alumni.

A full array of these plans, some of which were discussed in an earlier editorial in this series, has been prepared by The Council for Financial Aid to Education (6 East 45th Street, New York City 17) and is available for the asking. Also, colleges and universities have established in most states and regions cooperative associations to help business help them. The Commision on Colleges and Industry (912 Kahn Building, Indianapolis 4, Indiana) distributes a directory of these associations. And, of course, the colleges themselves are always eager to discuss their financial problems with business people and suggest constructive solutions.

Only Small Start Made

The plans for business aid to education which have recently attracted national attention constitute the conspicuous sort of leadership which it is the privilege and opportunity of our great corporations to provide. But the job is too large to be handled by a small number of business firms, no matter how bold or ingenious their programs.

To put our colleges and universities back on a firm footing financially the help of the great rank and file of business corporations is required. All of them, large and small, have a crucial stake in seeing that this job is done. The future of America will be decisively shaped by what happens in and to our college classrooms.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

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Donald C. McGraw

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B.C. Battle Looms

British Columbia Electric, provincial group become involved in Power River line hassle

Announcement by British Columbia Electric Co, Ltd, that it would begin surveys this month for $4.5 million, 132,000-v power line to British Columbia's upcoast pulp and paper town of Powell River has landed the company right in the middle of a hassle with the British Columbia Power Commission.

Spokesmen for the power commission declared that until the recent announcement (made jointly with the Powell River Co), it had assumed the government's public utility would install a transmission line to Powell River to take over the present company-owned industrial and domestic distributing system.

Commission's Viewpoint . . . James McKeachie, power commission spokesman, following the announcement, insisted the commission was "quite prepared to go into Powell River and surrounding communities with comparable rate to what anyone else can offer, and to serve adequate and sizable power to company and residents."

BCE officials point out, however, that the power commission could not supply sufficient industrial power to the Powell River Co from its 14,000 hp Clowhom Falls station, or from anywhere else at present.

The power commission has not disclosed where it will get the necessary power.

The announcement also brought a demand from provincial socialist group spokesmen that the government should take over BCE to prevent that company "from taking over."

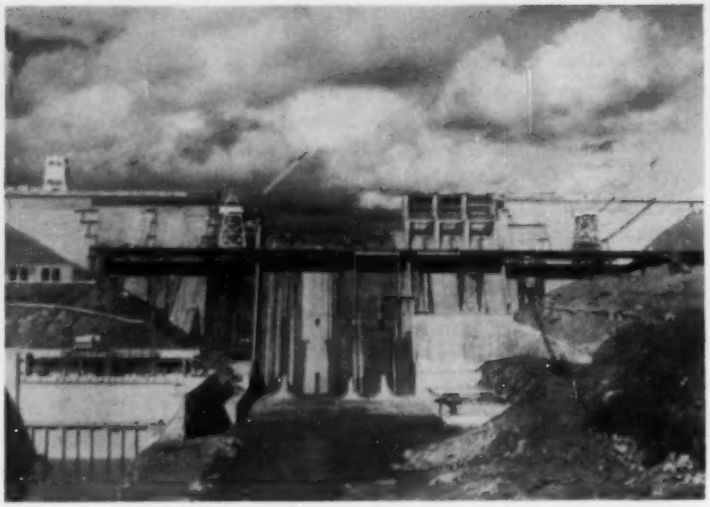
Robert Strachan, Co-operative Commonwealth Federation MLA, said real issue in dispute was "public or private ownership" of power facilities in the province.

"Government must get off the fence. It's going to be either public or private ownership," Strachan said.

BCE Position Defined . . . BCE officials said that it was a question of both the commission and the company serving in the communities which each is best equipped to serve and "there never has been any question at any time of BCE taking over the power commission."

"We think each has its own particular field."

Decision on who serves Powell River area with power will hinge on two factors: (1) Whether BCE or the commission gets the contract to serve the big block of industrial power to Powell River Co; and (2) whether PUC will give BCE a "certificate of public necessity and convenience" to serve the area.



Operations Under Way at Folsom Dam

Water flows through Folsom Dam and into the main channel after closing of diversion tunnel, marking start of operation at Army Corps of Engineers' dam on the American River, north of Sacramento, Calif. The 1,500-ft long tunnel was used for three years to divert the river's flow while the $40 million concrete dam was flung across the main channel.

Meantime, Bureau of Reclamation work on Folsom power plant and Nimbus afterbay dam and power plant is moving along. First of Folsom's three 54,000-kw generators went on the line April 15, and the first of two 6,750-kw Nimbus units went on the line in March.

Nominations Open

Opening of nominations for 1954's outstanding young electrical engineer has been announced by Eta Kappa Nu Association, national electrical engineering honor society. Nomination forms may be obtained from A. B. Zerby, Eta Kappa Nu executive secretary, Dillsburg, Pa., and must be returned by May 31. Candidates must be under 35 and have electrical engineering degrees from United States or Canadian colleges.

Backs San Luis Transfer to Feather River Project

Operation of the San Luis Project by the State of California as part of the Feather River Project instead of integrating San Luis with the Central Valley Project has received the backing of California Gov Goodwin J. Knight.

Knight promised Sen Thomas H. Kuchel he would appear in Washington, if necessary, to support a proposed Kuchel amendment that provides for transfer of the San Luis Unit, upon completion by the federal government, to the state's Feather River Project. It also commits Trinity River power to aid financially in the Feather River Project.

The amendment is designed to eliminate what Kuchel termed "unnecessary competition" between the groups supporting the Kuchel-Knowland bill (S 178) authorizing construction and operation of the Trinity River Division and the San Luis Unit as part of the Central Valley Project, and those favoring early construction of the Feather River Project.

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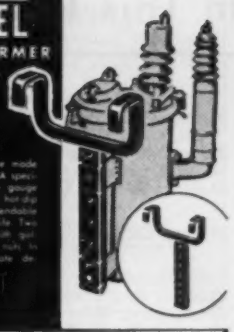

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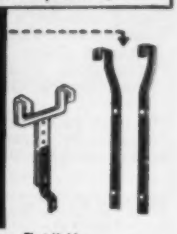

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Utility Relocation Hassles Flare in Ohio, Wisconsin

Three controversies among utilities and local and state governments involving construction and relocation of utility lines have flared into the news.

• In Ohio, utilities in every major city filed briefs in a case, recently heard by the state supreme court, to determine if townships and counties, through adoption of a master plan for community growth, can prevent appropriation of land for utility lines. The case, between Ohio Power Co and Franklin County, concerns the utility's right to erect towers and string high voltage lines across two townships in the Columbus area.

• Milwaukee, Wis., county expressway commission instigated negotiations with privately owned utilities which may lead to exemption of the utilities from paying total cost of relocating underground and overhead facilities that interfere with expressway construction. A bill before the State Assembly would require private utilities to pay all relocation costs, but would exempt publicly owned utilities.

• The City of Milwaukee's streets-zoning committee has urged the common council to make operative a year-old ordinance authorizing the commissioner of public works to order utility poles removed whenever he thinks necessary. The committee believes that the ordinance will minimize disputes between electric utilities and the city over removal of poles to permit street paving.

CILCo Service Cut Off by Transformer Failure

Service to half the city of Peoria, Ill., and some outlying districts recently was interrupted, in some cases for two days, when a 75,000-kva auto transformer failed for undetermined reasons at Central Illinois Light Co's East Peoria plant. The transformer was connected to a 60,000-kva generator.

Most of the utility's customers were back in service within two hours after the breakdown. But service to some industrial, commercial, and mining customers in outlying areas was not restored until two days later, after the weekend. Neighboring utilities co-operated to relieve the emergency as quickly as possible.

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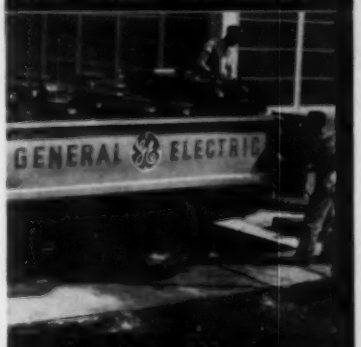

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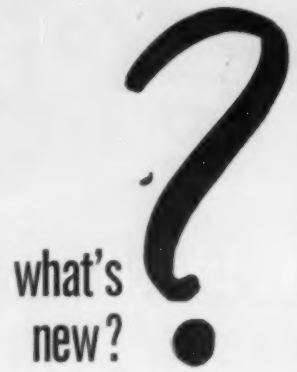

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SALESMAN, experienced in calling on utilities, needed to head up a well established North Atlantic states territory for eastern manufacturer of pole line hardware specialties. Current earnings five figures. Expenses. Incumbent retiring because of exigencies beyond his control. Reply enclosing resume.

P-6233, Electrical World
330 W. 42 St., New York 36, N. Y.

SALES ENGINEER

Opportunity for man, 25-40, with E. E. or M. E. degree and selling experience, to establish himself as direct sales representative in Wisconsin for growing transmission and distribution equipment manufacturer. Power company experience helpful. Starting salary range $5,800 to $7,000, depending on experience and qualification plus annual bonus, expenses, retirement plan, merit increases. Write details age, education, experience. Confidential.

P-6251, Electrical World
520 No. Michigan Ave., Chicago 11, Ill.

Manufacturer's Agent Wanted

Large manufacturing organization will appoint one or more representatives for the sale of its products in the Southeastern Section and Texas. Coverage desired for utility and industrial purchasers in territory. Experience in heavy power supply and high voltage equipment desirable. Correspondence and negotiations confidential. Address all replies to

RW-6142, Electrical World
330 W. 42nd St., New York 36, N. Y.

WANTED

ELECTRICAL ENGINEER

for Public Utility. Technical Work.

***WRITE* ELECTRICAL ENGINEER**
Central Illinois Public Service Co.
Springfield, Illinois

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1111 Wilshire Blvd. (17)

POSITIONS VACANT

Distribution Engineers—Graduate Electrical Engineers—Senior—at least 10 years field experience with operating utility company. Junior 3 years experience. Permanent position long established consulting organization New York. Some travel Latin America necessary in future. Knowledge of Spanish or Portuguese useful. Salary commensurate with experience. Reply stating age, education, experience, personal particulars and minimum salary expected. P-6291, Electrical World.

Distribution Engineers—Two competent graduate electrical engineers, age 30 to 40, with minimum 8 years experience design, operation and maintenance of distribution facilities, required by rapidly growing utility, desirable location South America. Portuguese or Spanish useful—not essential to start. Reply stating age, education, experience, personal particulars and minimum salary expected. P-6292, Electrical World.

POSITION VACANT

Electrical Designers and draftsmen. Minimum three years experience in the design of public utility steam power stations. Western Pennsylvania. Reply to P-5783, Electrical World.

EMPLOYMENT SERVICES

Salaried Personnel, $3,000-$25,000. This Confidential service established 1920, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. L, 241 Orange St., New Haven, Conn.

Salaried Positions $5,000 to $35,000. We offer the original personal employment service (established 45 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars. R. W. Bixby, Inc., 658 Brisbane Bldg., Buffalo, N. Y.

POSITIONS WANTED

Graduate Electrical engineer, 30 years of age desires responsible position installing and maintaining carrier current, relaying, supervisory control and metering equipment. PW-6239, Electrical World.

Electrical Engineer, with outstanding record of 25 years of wide and varied experience in supervision, engineering and design of large hydro and steam-electric power projects. Last 10 years in executive positions. Have been chief E. E. with consulting firm and E. E. in charge with engineering organization of large South American utility company. Can furnish excellent references. Married, no children, no objection to traveling or foreign assignment for US company. Desires responsible executive position. Presently employed but desires change. PW-6099, Electrical World.

PERIODICALS

A.I.E.E. transactions back-volumes wanted to buy for cash. Ashley, 24 E. 21, N.Y.C. (10).

OFFICIAL PROPOSALS

Bids: May 17, 1955

Power Authority Of The State Of New York

ST. LAWRENCE POWER PROJECT
ADVERTISEMENT FOR PROPOSALS
FOR
THE FURNISHING AND DELIVERY OF GENERATOR GROUNDING CUBICLES
SPECIFICATIONS NO. PA-5-14007
ST. LAWRENCE CONTRACT NO. P16

NOTICE TO CONTRACTORS: The POWER AUTHORITY OF THE STATE OF NEW YORK will receive sealed proposals for the design, manufacture, and furnishing of sixteen (16) generator grounding cubicles and delivery thereof f.o.b. the Authority's classification yard, Massena, New York in the following ways:

(1) If brought in person, on the day of receiving bids until 10:30 A.M. Eastern Daylight Saving Time on the 17th day of May, 1955, 270 Broadway, Room 1704, New York, New York.

(2) If mailed in, until 10:15 A.M. Eastern Daylight Saving Time on the 17th day of May, 1955, at the Authority's office, 270 Broadway, Room 1300, New York 7, New York.

Bids will be entertained for 16 generator grounding cubicles and associated equipment and services in accordance with the bidding schedule. Erection at the site of installation will be done by others but services of an erecting engineer shall be provided by the manufacturer if and when required.

Plans, specifications and Proposal Forms for the work will be on file in the Authority's office and in the offices of the Engineer, Uhl, Hall & Rich, 220 Congress Street, Boston 10, Massachusetts, and the Hydro-Electric Power Commission of Ontario, 620 University Avenue, Toronto 2, Ontario, and may be inspected by prospective bidders during office hours.

Plans specifications, and Proposal Forms may be obtained from the Power Authority of the State of New York, 270 Broadway, Room 1300, New York 7, New York, upon application and prepayment of a fee of Ten ($10.00) dollars per initial set of contract documents and Five ($5.00) dollars per set for additional sets, no part of which will be refunded. Two sets must be returned with each bid.

Bids must be made in duplicate upon the proposal forms included in and bound with the Contract Documents. Bid deposit will be required with each bid in an amount not less than 10 percent of the price bid for the schedule.

The right is reserved to reject any or all bids.

W. S. CHAPIN
PA-5-14006 GENERAL MANAGER

SALESMEN WANTED

To carry our line of rubber glove protectors and linemen gloves, as a side-line. Prices are below our competitors. Quality—the best. Good commission.

SW-6308, Electrical World
520 So. Michigan Ave., Chicago, Ill.

OFFICIAL PROPOSALS

proposal forms included in and bound with the Contract Documents. Bid deposit will be required with each bid in an amount not less than 10 percent of the price bid for the schedule.

The right is reserved to reject any or all bids.

W. S. CHAPIN
PA-5-14007 GENERAL MANAGER

Bids: May 17, 1955

Power Authority Of The State Of New York

ST. LAWRENCE POWER PROJECT
ADVERTISEMENT FOR PROPOSALS
FOR
THE FURNISHING AND DELIVERY OF HIGH PRESSURE OIL PIPE-TYPE CABLE
SPECIFICATION NO. PA-4-14004
ST. LAWRENCE CONTRACT NO. P10

NOTICE TO CONTRACTORS: The POWER AUTHORITY OF THE STATE OF NEW YORK will receive sealed proposals for the design, manufacture, and furnishing of two (2) circuits of 230 kv high pressure oil, pipe-type cable and appurtenances and two (2) circuits of 115 kv high pressure oil, pipe-type cable and appurtenances and the delivery thereof f.o.b. the Authority's classification yard, Massena, New York, in the following ways:

(1) If brought in person on the day of receiving bids until 2:30 P.M. Eastern Daylight Saving Time on the 17th day of May, 1955, 270 Broadway, Room 1704, New York, New York.

(2) If mailed in until 2:15 P.M. Eastern Daylight Saving Time on the 17th day of May, 1955, at the Authority's office, 270 Broadway, Room 1300, New York 7, New York.

Each circuit of high pressure, oil pipe-type cable shall consist of the high voltage cable, the steel pipe for the three-phase cable run, non-magnetic pipe (copper tubing) for the single-phase cable runs, terminal assemblies (potheads), three-conductor trifurcating joint assemblies or sleeves, straight joint and splice assembly, special insulating oil and appurtenance for connecting the three (3) single phase transformers to the switchyard bus. A dual pumping plant, including all electrical controls, oil reservoir, and all necessary valves, piping (not embedded), gages, and other appurtenances necessary to operate system as specified in the Technical Provision of this specification, will be required for the two 230 kv circuits and a similar dual pumping plant for the 2-115 kv circuits. Delivery of the first 115 kv cable circuit will be required on or before July 1, 1957, and the remainder of the cable circuits to be delivered in accordance with the delivery schedule in this specification. Bids will be entertained only for all four circuits and associated equipment and services in accordance with the bidding schedule. Erection at the site of installation will be done by others, but services of an erecting engineer shall be provided by the manufacturer if and when required.

Plans, specifications, and Proposal Forms for the work will be on file in the Authority's Office and in the offices of the Engineer, Uhl, Hall & Rich, 220 Congress Street, Boston 10, Massachusetts, and the Hydro-Electric Power Commission of Ontario, 620 University Avenue, Toronto 2, Ontario, and may be inspected by prospective bidders during office hours.

Plans, specifications, and Proposal Forms may be obtained from the Power Authority of the State of New York, 270 Broadway, Room 1300, New York 7, N. Y., upon application and prepayment of a fee of Ten ($10.00) dollars per initial set of contact documents and Five ($5.00) dollars per set for additional sets, no part of which will be refunded. Two sets must be returned with each bid.

Bids must be made in duplicate upon the proposal forms included in and bound with the Contract Documents. A bid deposit will be required with each bid in an amount not less than 10 per cent of the maximum price bid for any bid schedule.

The right is reserved to reject any or all bids.

W. S. CHAPIN
GENERAL MANAGER

OPPORTUNITIES!

in

New and used equipment recently released from service by a number of electric and gas utility companies

POWER PLANT EQUIPMENT
CONSTRUCTION EQUIPMENT
SUBSTATION EQUIPMENT
TRANSMISSION LINE MATERIALS

Send for new list, . . . to

EBASCO SERVICES INCORPORATED
(APPARATUS EXCHANGE)
Two Rector St., New York 6, N. Y.

FOR SALE

One W.H. Transformer, 100 KVA 33000/2400 oil-cooled, 1 phase, 60 cycles, subtractive polarity. Imp. 6.0 Ser. #463694. Two Moloney Transformers, 100 KVA. 16500/33000, oil cooled, 1 phase, 60 cycles, 2300 Volts to 2530, 5.25 Imp. subtractive polarity. Type FC. Serial No. 605530 & 531. Price can be arranged to suit purchaser.

FS-5985, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL **WIRE** AND **CABLE**

—Your Best Source—

- for every industrial and power application
- Odd lengths—long and short—reasonably priced

One of the Largest Stocks in Midwest
Let us quote on requirements—
send your inquiries
We'll also buy Surplus
Branch Offices
Houston— Yukon 8847
Los Angeles— ANgeles 3-5148

UNIVERSAL Wire and Cable Co.
2562 N. Clybourn Ave., Chicago 14, Ill.
EAstgate 7-4777 Cable: UNIWIRE

Don't forget the Box Number . . .

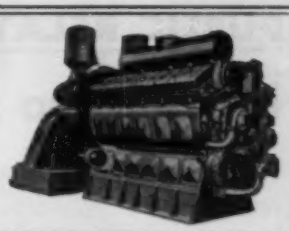
when answering the classified advertisements in this magazine. It's our only means of identifying the advertisement you are answering.

U. S. Government

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-4408) will be received at Denver, Colorado, until June 9, 1955, for furnishing seven 115-kv (550-kv BIL), 1,200-ampere, 2,500,000-kva power circuit breakers for Palisades Switchyard, Palisades Project, Idaho. Delivery is desired within 300 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 2, Colorado. W. A. Dexheimer, Commissioner.

DIESEL POWER

IMMEDIATE SHIPMENT
• PURCHASE OR RENTAL
UNIT CAPACITIES—10 TO 2475 KVA
A.C.—50 AND 60 CYCLES
• ALSO D.C. UNITS



A PARTIAL LISTING OF OUR INVENTORY

KW	MAKE	Model	HP	RPM	KW	Make	Model	HP	RPM
1180	Worthington	8EH-8	1685	360	220	Superior	6DE-6	460	450
1136	Fairbanks Morse	38D	1600	720	300	Fairbanks Morse	32E14	450	300
1100	General Motors	16-278A	1600	720	300	General Motors	8-268A	450	1200
1000	General Motors	16-567B	1440	720	250	Clark	GD-4	375	360
750	General Motors	12-567	1080	720	200	General Motors	8-268A	350	900
700	Worthington	EE-8	1000	327	175	General Motors	12-71	275	1800
675	Fairbanks Morse	38D	960	720	150	Buckeye	90	240	600
500	General Motors	8-567	720	720	148	Fairbanks Morse	32E14	220	300
500	Alco	6-12 x13T	750	600	100	General Motors	3-268A	150	1200
350	Baldwin	VO-6	510	450	60	General Motors	6-71	90	1200
320	Enterprise	DSG-6	460	450					

A. G. SCHOONMAKER COMPANY, INC.
DIESEL DIVISION, 50-52 CHURCH ST., NEW YORK 7, N. Y.

TRANSFORMERS

FOR SALE

3—1000 Kva W-H 20000/34650Y-13200
3—1000 Kva Mol. 13200-2400/4160Y
6—1000 Kva Mol. 11500-2400/4160Y
3— 833 Kva G-E 33000—480
3— 500 Kva G-E 26400—240/480
5— 333 Kva W-H 38800-7200/12470Y
3— 333 Kva G-E 33000-2300/4000Y/6900/-11950Y
3— 333 Kva G-E 33000-2300/4000Y
3— 333 Kva Mol. 7200/12470Y-2400/4160Y
3— 100 Kva G-E 33000-6900/11950Y

Many other items in stock.

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.
5316 Hetzel St.
Cincinnati 27, Ohio

40 Years' Dependable Service

MOTORS · GENERATORS
TRANSFORMERS
NEW · REBUILT
WORLD'S LARGEST INVENTORY
ELECTRIC EQUIPMENT CO.
PHONE STATION COLLECT GL 6781

FOR SALE

IN OKLAHOMA and MISSOURI

12 500 HP 4 cylinder vertical diesel engines and 5-⅜" x 36" and 6-¾" x 24" horizontal triplex plunger pumps fitted with steel fluid ends.

Operational changes *render* surplus. Complete data upon request. Would consider sale of either item separately.

CITIES SERVICE PIPE LINE
Patridge, Bartlesville, Oklahoma

SUBSTATION EQUIPMENT

TRANSFORMERS

QU.	KVA	MFR	VOLTAGE
3	1000	Mol.	110,000—460
1	10000	A.C.	66000—33000, 3 ph.
1	3750	West.	69000—14400 8ph.
4	2500	Mol.	66000—13800
4	750	G.E.	66000/114000—13200
4	500	West.	69000—6900
3	400	G.E.	66000/33000—2300/4158
3	333	Stand.	69000/34500—7200/12470 Y
3	200	Pitts.	66000—2300
3	1500	Wag.	44000—6900
3	1250	A.C.	44000/11500—460
3	75	Rel.	44000—7200/12470 Y
1	7500	A.C.	39838/69000 Y—13200, 3 ph.
3	5000	G.E.	38100/66000—6600
1	3750	Penna.	38030/65865 Y—13800, 3 ph.
4	3333	G.E.	38100/66000 Y—33000
4	3125	Mol.	39900/66000 Y—26000/46000 Y
6	2000	Mol.	38100/66000 Y—13800
3	3333	G.E.	33000/11000—2400/7200
1	3000	G.E.	33000—6900/2300, 3 ph.
2	3000	Stand.	33000—4160, 3 ph.
1	2000 Kuhl.		33000—6900, 3 ph.
4	333	G.E.	34500—13800/23900 Y
3	200	A.C.	34500—2400/7200/12470 Y
3	75	Wag.	33000—240/480
2	3750	G.E.	26400—4360/2520, 3 ph.
3	1250	G.E.	26400/13200—2400
4	1500	A.C.	25400/44000 Y—6900/13800
4	833	G.E.	14400/24900 Y—2400/4160 Y
4	450	A.C.	25410/44000 Y—13200/23000
3	100	G.E.	22000—7200/12470 Y
3	667	A.C.	19053/33000 Y—2400/4160 Y
1	600	Stand.	13200—2300, 3 ph.
1	450	Penna.	13200—2400, 3 ph. ASKAREL
1	200	G.E.	13200—2400
4	167	G.E.	7200/12470 Y—2400
3	125	A.C.	6900—2300
3	37½	G.E.	6900—230/460
4	150	G.E.	4800/2400—240/120
2	100	G.E.	4800/2400—240/480
3	333	G.E.	2400/4160 Y—460
3	250	G.E.	2300/4000 Y—115/230
3	200	West.	2400—240/480
3	150	West.	2400—230/115
1	100	G.E.	2300—575, 3 ph

ALSO:—FREQUENCY CHANGERS
MOTOR GENERATOR SETS
SYN. CONDENSERS
OIL CIRCUIT BREAKERS
FEEDER REGULATORS, ETC.

BREW, WOLTMAN & CO., INC.
52 Church St. New York 7, N. Y.

Specialist for 47 Years in—

LARGE POWER EQUIPMENT

Do you receive our stock list? Prompt shipment from inventory. A.C. & D.C. Motors, Transformers, M-G Sets, Frequency Changers, Controls, Turbo-Generators and Circuit Breakers. Attractive prices for rebuilt-guaranteed equipment. Contact us before purchasing.

BELYEA COMPANY, INC.
51 Howell St. Jersey City 6, N. J.

It's Chicago May 12 for PUAA

Utility advertising men will gather for 34th annual convention. AEC's W. Kenneth Davis will be guest speaker

The Public Utilities Advertising Association looks for a record turnout at the 34th annual convention in Chicago next week (May 12-13). A stimulating program has been arranged.

Highlight of the meeting will be the announcement of the results of the Better Copy Contest, the 32nd such contest conducted by the PUAA. Over 2,000 entries were received from about 300 companies this year. There are 23 classifications.

Special interest this year will center around the speaker at the May 12 dinner. He will be W. Kenneth Davis, director of reactor development for the Atomic Energy Commission. Davis will talk on "The Atomic Future for the Electric and Gas Industries." With the current interest in atomic power developments in utility circles, this talk should meet with eager reception.

In addition to Davis, other interesting speakers and sessions have been arranged. Presidents John W. Evers of Commonwealth Edison Co, and Eskil I. Bjork of Peoples Gas, Light & Coke Co, will be the principal speakers at luncheons. Other speakers and their subjects include: J. Stanford Smith, manager of general public relations, General Electric Co ("The Force of Public Opinion in the Decade Ahead"); Eldred Scott, vice president, Detroit Edison Co ("Financial Aspects of Public Utilities"); Bill Miller, art director, General Outdoor Advertising Co ("What Makes Good Poster Copy"); Raymond Bradstrum, advertising writer, Illinois Bell Telephone Co ("Direct Mail for Utilities"); and others.

The session talks generally will follow the Boston "case" technique.

The ECAP copy group will hold their usual pre-convention meeting on May 11. The Thursday (May 12) schedule includes a one-hour boat excursion on Lake Michigan.

PG&E Takes Outdoor Poster Awards

The outdoor advertising campaign of Pacific Gas & Electric Co has won two awards in the third annual Local Outdoor Advertising Contest sponsored by the Outdoor Advertising Association of America, Inc.

The picture above shows the type of outdoor advertising that scored for PG&E. The company's campaign in San Francisco won second award in the Four to Eleven Month Poster Campaign Division, and its Sacramento campaign was selected to receive second award in the Rotary Paint Campaign Division.

The contest, conducted since 1952, is open to all categories of local business in all parts of the country using outdoor advertising.

TVA Area Coal Firm Plugs Electric Industry

The Nashville Coal Co, Nashville, Tenn., has entered the battle in behalf of the private electric industry with a series of page advertisements.

The coal company says the electric industry, which it describes as the "Whipping Boy of America," is the wonder of the world in performance. Its prices are lower than 25 years ago; service is almost perfect and the quality of power has been improved immensely over the years; and it pays high taxes and makes other important contributions to our country, the ads point out.

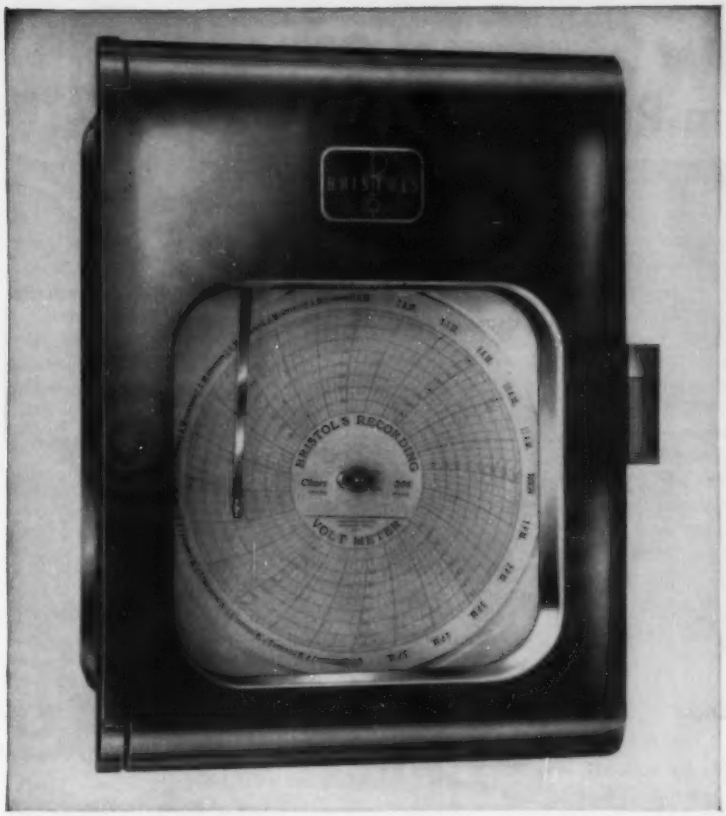
"Politicians for their personal, private benefit have made the electric industry a whipping boy for 20 years. The electric industry generally needs only to keep the facts before the public to stop unjust persecution," says the coal company.

CP&L Reports Progress In Finer Carolina Contest

A total of 154 towns have entered the fourth annual "Finer Carolina" contest and have undertaken almost a thousand different projects, according to a survey by Carolina Power & Light Co, sponsor of the program.

Most popular projects dealt with some form of recreation. More than 100 were listed, including plans for five new parks, 11 new playgrounds, enlargement of 13 old parks, improving 14 playgrounds, organizing 22 recreational programs, and revitalizing 43 old recreational programs.

Civic improvements during the coming year also will include new swimming pools, community houses, home beautification, tree-planting, street paving, and other improvements. Prizes totaling $6,700 await the winners in three groupings.



NEW, EASY-TO-READ BRISTOL RECORDING VOLTMETERS AND AMMETERS are available for permanent mounting or for use as portable instruments.

You'll get greater accuracy, greater dependability with Bristol recording voltmeters and ammeters

Here's why:

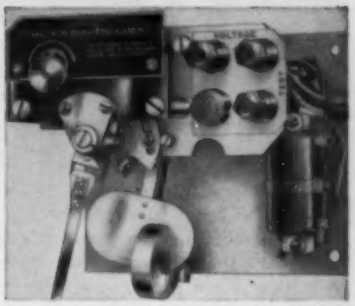
1. Low electrical burden — the lowest burden of any round-chart recorder on the market.
2. Extremely high torque gradient.
3. Temperature compensation.
4. Shock-proof measuring mechanism mounting.
5. Leveling of instrument not critical.
6. Continuously legible recording of sudden changes — up to full scale value.

These modern units are designed for easy use, with dust- and moisture-proof die-cast aluminum case; quick-set chart hub for easy chart changing; non-obscuring pen lifter; and snap-on chart plate.

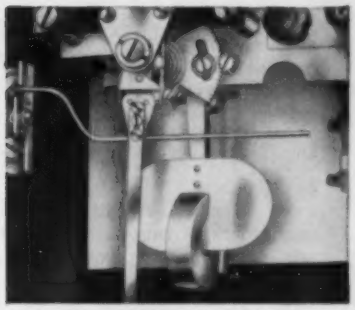
Get the whole story on these precision instruments. Write today for free 28-page Bulletin E1111 to THE BRISTOL COMPANY, 116 Bristol Road, Waterbury 20, Conn.

Many ranges carried in stock for immediate delivery

LOOK AT THESE FEATURES!



NEW MEASURING MECHANISM — High-quality, accurate, dependable Bristol moving-iron mechanism used in all models.



MAGNETIC DAMPING — all models equipped with aluminum vane and alnico magnet damper which gives maximum speed of response possible with minimum overshoot.

PEN MOUNTING — Pen-arm mounting shaft firmly supported at both ends — eliminates trouble from back-lash and lost motion. Pen arm is readily removed and replaced.

BRISTOL

POINTS THE WAY IN HUMAN-ENGINEERED INSTRUMENTATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

READERS FORUM

Industry Museum Proposal Gathering Support

Manufacturer Calls Suggestion Timely

To the Editor:

We wish to support heartily the program outlined in the second editorial of the March 28 issue, entitled "First an Inventory."

We are so close and so busy in the activity of making and using the blessings of the electrical age that we find little time and less space for the pioneering apparatus that made this age possible. As the next century comes quickly by, the inspirational value of this equipment will be sorely missed. The carelessness and thoughtlessness of this generation in not providing a record and house for the historical equipment made and used by the early pioneers will mean that much less to inspire future generations. Your editorial is timely in calling this to our attention.

Bern Dibner
President

Burndy Engineering Co, Inc
Norwalk, Conn.

Encyclopedia Editor Sends Congratulations

To the Editor:

My attention has just been called to an editorial in your March 28 issue entitled "First an Inventory, Then a Museum," which I found of particular interest. As you say, the thousands of items of early electrical sketches, plans, and mechanisms (many, doubtless, of greatest historic value) which are now scattered about the country in private hands should first be located.

I quite agree that the making of an inventory should be the first step, and copies of it should be made available to the Smithsonian and all other museums having electrical equipment in their collections, both in the United States and in foreign lands.

I believe the report that such an inventory was being prepared would stimulate widespread interest in the electrical industry to take the second step you advocate, the establishment of a national museum of electricity.

Permit me to congratulate you on your initiative in proposing a program of such high educational value. I am sure you will find science teachers in thousands of our schools and colleges unanimously for your idea.

Lavinia P. Dudley
Executive Editor

The Encyclopedia Americana
2 West 45th Street
New York 36, N. Y.

Municipal Official Suggests Kansas City

To the Editor:

Here is a copy of a letter sent to the managing editor of the Kansas City Star. It concerns the museum proposed in your editorial of March 28.

"We are attaching hereto a clipping from the March 28 issue of the Electrical World which we believe will be of interest to the Kansas City Star.

"It is obvious a museum of the electric power industry would have incalculable value historically and be of great interest to engineers and students of engineering. It is our opinion a museum of this nature should be centrally located, available to all sections of the United States.

"In our judgment Kansas City is the ideal location."

O. L. E. Haff
Superintendent

City Water and Light Department
Ottawa, Kansas

Purdue Professor Favors St. Louis

To the Editor:

In the March 28 issue you suggest that a national museum of electricity should be established.

Recently Purdue University donated to the Museum of Transport, Barretts Station Road, St. Louis 22, Mo., a number of electrical museum pieces. As this museum has a nucleus for the type of museum that you have in mind and as St. Louis is a central location, I suggest that you contact Dr John P. Roberts who is director of the above museum. I think that Dr Roberts would be interested in expanding his museum.

Prof George V. Mueller
Electrical Engineering

Purdue University
Lafayette, Ind.

400-Amp Service Story Attracts Interest

To the Editor:

We have received inquiries from several of our customers who are interested in a 400-amp service installed in Anniston, Ala. (EW, Jan. 17, p 15).

We should like to contact the architect and engineer responsible for this project in order to obtain additional information on the electrical controls, etc.

Can you give us the names and addresses of these people.

A. C. Fusaro
Construction Materials Sales

International General Electric Co
570 Lexington Ave
New York 22, N. Y.

● Farley Berman, the owner, was responsible for most of the electrical ideas incorporated in the house. Electricity is one of his hobbies, and he desired the house to be as completely electrified as possible.

A few of the ideas were supplied by James M. Hoffman, the architect, and J. W. Holland, who is Anniston Division Sales Supervisor of Alabama Power Co, and a friend of Mr Berman.

For further information write to Mr Farley Berman, Champaign Avenue, Anniston, Ala.

ACCO products

ACCO Registered* Wire Rope Slings

THE STANDARD OF EFFICIENCY AND SAFETY

• Hoisting equipment like this giant rotor for a 135,000 KW turbo-generator is ticklish business. No preventable risks can be tolerated. That's why manufacturers of electrical generating and transmitting equipment, as well as utility organizations all across the country, have standardized on ACCO *Registered* wire rope slings.

For ACCO *Registered* slings incorporate extra safeguards which make them the safest wire rope slings available. Each individual component, made from the highest quality material suited to its use, is individually tested—must prove to have strength equal to or greater than the sling body.

The components are then precision-assembled into slings according to carefully engineered designs which have proven their safety and efficiency in extensive field tests. Each completed sling is individually proof-tested at twice the load-carrying capacity for which it is rated. Then and only then is the sling awarded the ACCO *Registered* tag and certificate.

This careful engineering and these extensive quality control measures insure precision manufacture and the greatest possible factor of safety. They explain the overwhelming preference for ACCO *Registered* slings in utility and electrical manufacturing operations.

And ACCO *Registered* slings cost less in the long run. Because they have been carefully manufactured according to precisely engineered designs, they last longer—add savings to the additional safety which is their outstanding recommendation for electrical manufacturing and utility use.

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Better Value

WASHINGTON COMMENT

Bill Offered to Get Partnership Rolling

Legislation would permit federal ownership of all facilities, but local utilities would finance power portions and get entire output of projects

Congressman Sam Coon's bill to authorize immediate federal construction of the 1,105,000-kw John Day Dam in Oregon (EW, April 25, p 10) is important because it would provide a huge block of new power for an area in tight supply and because it would save the taxpayers an outlay of at least $273 million.

Beyond this, however, the bill introduced by the Oregon Republican has even greater importance because it heralds a significant shift in the Administration power policy.

Still Partnership but with a Difference . . . It is still a full partnership policy, but the difference comes in ownership of facilities. As originally stated, Administration policy contemplated divided ownership of hydroelectric and multipurpose developments. Local interests, public and private, would finance, construct, and own the power portion of these projects. The federal government would finance, construct, and own the remaining portion of the project.

Under Coon's bill the federal government will hold title to the entire project even though local interests will finance and construct the power portions of the project. The local interests, for their share, will receive the power output of the facilities under long-term contracts.

There are two good reasons for this proposed modification of the partnership policy. First, Administration backers hope it will put the damper on critics who have dubbed their policy a "giveaway." With the federal government holding title to the projects, it is believed this tag will be less applicable. Second, Administration backers believe the change will result in speeding up actual construction under the partnership policy.

A rundown of the status of partnership projects considered thus far indicates the Eisenhower policy has been slow in getting off the ground:

- Markham Ferry project on the Grand River in Oklahoma with a capacity of 75,000 kw has been authorized, but the local interests have only recently applied for a federal license to build the project.
- Coosa River development, 239,000 kw, has been authorized for construction by the Alabama Power Co, but the company must still seek federal licenses for the five-dam project.
- Cougar-Green Peter Dams in Oregon are slated for a partnership try-out, but the necessary legislation still has not been passed. These projects would have an installed capacity of 135,000 kw.
- The Upper Colorado, Fryingpan-Arkansas projects have all-out Administration support although they are not considered partnership projects in the strict sense.

It adds up to this: Much preliminary and legislative work has gone into support of the partnership approach. Practically no actual building is underway as a result of it.

Coon Bill Looks to the Future . . . Administration backers believe the Coon bill will get construction underway in the power-hungry Pacific Northwest. The utilities there realize that something must be done if they are to meet rapidly increasing loads. That's why they're pushing the bill with all they've got.

Under the New and Fair Deals, Northwest power development was fed on a diet of about $100 million a year in public funds. The region in the next ten years may need as much as $2 billion for new power facilities—as much as was spent during the past two decades.

The Northwest knows it can't go on forever getting federal money at that rate. So utilities are willing to gamble on their new financing plan. In this way they will be fulfilling an obligation to consumers in the area and providing the basis for even greater industrial expansion. They don't expect favorable action on the bill in this session of Congress, but with a lot of spadework, they believe it will have a good chance next year.

TECHNICAL NOTES

Moving air is bonanza to utility engineers seeking to cool conductors and equipment. But aeronautical engineers find that supersonic speed of 5x sound velocity melts aluminum and 6x, steel.

Liquid-metal reactors require close control of chemical purity for proper operation. Refueling mixes can compensate for changes during operation.

Runoff to the sea disposes of 28% of rainfall on the land.

Bagdad has gained new fame. Its traders have staged an electrical exhibit.

Weatherproof plugs and sockets on control connections can facilitate maintenance and replacement of capacitor switches.

Detergent added to water makes it 20 times as effective for dousing fires.

Painting of about 3,000 towers on one system over 6 years averaged $73.60 each or $25.70 per ton of steel. Average weight was 2.8 tons per tower, labor $1.90 per hour.

Transformer oil is extracted from petroleum at a point intermediate between diesel and turbine lubes.

OPERATION VOLTAGE REPORT NO. 1

Key facts in the application of regulators and capacitors

	REGULATORS	CAPACITORS	REGULATORS AND CAPACITORS
QUALITY OF REGULATION	Maintain ±1 volt control in small steps	Produce fixed voltage rise depending on bank size	Provide better regulation than regulators or capacitors used alone
SYSTEM LOAD CAPABILITY	Raise output capability by virtue of increased output voltage	Raise capability of whole system and reduce thermal loading	Provide maximum system load carrying ability
REDUCTION OF LOSSES	Some reduction results from higher voltage, producing lower current for a given load	Reduce I^2R and I^2X loss on entire system	Provide economical reduction of system losses
VOLTAGE CONTROL DURING EMERGENCIES	Output voltage restored after short time delay within range available	Help sustain system voltage	Maintain highest emergency voltage level
LIGHT AND HEAVY FEEDER LOADS	Economical to install at lighter feeder loads	Economical to install at heavy feeder loads	Most economical at any feeder loading

Conclusion: FOR MAXIMUM ECONOMY USE REGULATORS AND CAPACITORS

Recent surveys show that most utilities are planning some means of voltage control on almost 90% of all their distribution feeders.

Since this represents a sizeable investment in equipment, G-E engineers have undertaken a comprehensive study of feeder voltage regulation problems to help utilities choose the equipment that provides economical voltage control.

The increasing use of capacitors as a means of regulating voltage has naturally led some engineers to look upon them as competing with regulators. This is not the case, since there is a definite place for each on any system.

The most important result of the analysis is that: When used jointly, capacitors and regulators *always* give superior voltage control, and greater return on system line and substation investment.

This is the first in a series of reports dealing with the important conclusions drawn from the study. For a complete discussion contact your G-E Sales Engineer for GER-1029 or write General Electric Co., Schenectady 5, N. Y. 645-1

PORTABLE DEMONSTRATOR being used by G-E Engineers R. M. Butler (left) and D. R. Samson to show effect of capacitors and regulators under variety of feeder load conditions.

GENERAL ELECTRIC

Pepco Gets Rate Increase

PUC grants $3.8-million-a-year hike in revenues, but Washington Gas fights 30% slash in electric water heating rates

The Public Utilities Commission of the District of Columbia has granted Potomac Electric Power Co a $3.8-million rate increase. This is 67% of the $5,715,000 a year hike requested by the company. In addition the PUC has agreed to the termination of the company's "Modified Sliding Scale Plan."

Washington Gas Light Co has intervened with respect to the proposed reduction of about 30% in the electric water heating rates. Oscar Berry, company attorney, said, "The rate reduction was obviously designed to promote the use of electric water heaters and may have a substantial effect on the gas company."

Increase Necessary

The basis of the proposed rate increase was Pepco's claim that "an increase in rates would be necessary to bring its earnings up to the previously allowed rate of return of 5½% on investment. In addition, it contends and has produced testimony to demonstrate that the fair rate of return at the present time would be 6½%, although for reasons of policy it has requested increases which would result in an estimated return of 6¼%."

The effect of large capital expenditures which the company had to make in rendering service was stressed in the PUC's order when it said: "It (the company) claims that the effect of the large capital outlays required for this purpose at the relatively high price levels obtaining in the recent past and at present has been a constant attrition in its earnings. In other words, under the present rate schedules increases in earnings from new facilities have not kept pace with the related increases in investment and thus the over-all rate of return has been progressively reduced."

"In recognition of this fact, and despite some difference in viewpoint as to the optimum capital structure," the order continued, "there is no basic challenge to the company's position that a substantial portion of its prospective financing should be by the sale of additional common stock and that effect should be given to this fact in determining the appropriate rate of return."

Since Pepco operates under four jurisdictions, the PUC in upholding the use of system-wide investment and revenues in setting rates of return said in part:

"In its review of the last rate order of this commission with respect to Pepco the Court of Appeals held that on the basis of the record in that case it appeared that Pepco constituted a single integrated operating entity in a cohesive area and that the use of system-wide investment and revenue figures as well as a single corporate rate of return was legally justified. The record in the present case, in which this issue has not been disputed, would clearly lead to the same conclusion and demonstrates the appropriateness of the use of system-wide figures."

In dealing with the rate of return, the commission made it clear that it would adhere closely to the straight "cost of money" concept. Significantly, it said: "This is in accordance with the standards upheld by the courts (**Federal Power Commission** v **Hope Natural Gas Co,** 320 U. S. 591; **Pennsylvania Water & Power Co** v **Federal Power Commission,** 87 App. D. C. 235, 193 F. 2d 230), and followed by this commission (See eg, re **Washington Gas Light Co,** 53 P. U. R. (N. S.) 321; re **Potomac Electric Power Co,** 55 P. U. R. (N. S.) 65)."

Federal Court Cases Involved

It is of interest to note that the above court decisions on which the PUC appears to base its approach rest in both instances on federal cases. The first arising from a Supreme Court decision in the Natural Gas Act and the second in a Court of Appeals decision wherein a rate reduction of a company in interstate commerce was in dispute.

As to the allowable rate of return, the PUC noted that the principal areas of disagreement were with respect to the equity portion of the capitalization. The rates of return were respectively 12% on common equity by the company witness, 8.9% to 9.4% by the PUC witness, and 9.32% by the

(*Continued on page* 168)

Rate Hike Awarded Home L&P

The Colorado Public Utilities Commission has granted Home Light & Power Co an increase of $126,419 a year in rates. Of this amount $23,568 represents the applicant's increased cost of purchased power from the Public Service Co of Colorado. The increase in rates was allocated as follows: Residential 8.70%, commercial 5.06%, power 6.15%, municipal 1.35%.

As to the commission's findings on the company's application for a rate increase, the following points were given consideration by the PUC:

The company presented both a reproduction cost new rate base of $8,328,000 and a present value rate base of $6,124,000 as well as an original cost rate base of $4,347,000.

The PUC, in dismissing all evidence of value because of prior decisions, said ". . . suffice it to say that we believe that by the use of an original cost-type rate base on a year-ending period in times of inflation, with some consideration because of attrition and regulatory lag, we can arrive at an equitable end result." Included in this original cost rate base were construction work in progress and materials and supplies but no cash working capital.

As to the rate of return, the company's request for a 6.9% rate of return was reduced to 6.32% by the PUC. The principal difference was in the earnings on the common stock equity which the company contended should have been 11.30% while the commission said a fair return would be 10%.

SPECIFY **P-W** FOR

CABLETROF TUBETROF *Twist-Rack*

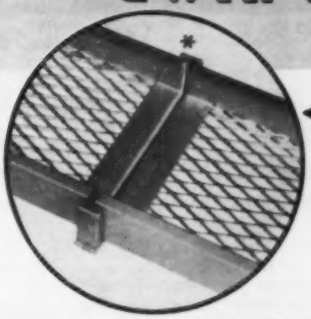
AND CABLE INSTALLATION EQUIPMENT

P-W salutes the Philadelphia Electric Co., as the originators, designers and first users of a cable trough system made of expanded metal. As a result of this pioneering by P. E. Engineers, other Utilities, Industrials and Governmental Agencies have benefitted in lower cable installation costs.

P-W again offers additional savings with (1) its new EXTENSION FITTING, which eliminates cutting of trough to complete runs, and (2) with its built-in

"QWIK-LOK" COUPLER

Savings up to **90%** in Assembly Time



For trough with channel sides.

For trough with expanded metal sides.

Just Takes One Man and a few taps of a Hammer

ALL WIDTHS AND HEIGHTS . . . ELIMINATES NUTS, BOLTS & WASHERS

This coupler provides: a stronger, quick-coupling — full support in bottom of trough — entirely hot-dipped galvanized — permits trough or fitting to be easily removed or inserted from side of run after original installation — bolt-on coupler also available — can also be used as Drop-Out fitting.

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WRITE FOR BULLETINS

P-W INDUSTRIES, INC. *Manufacturers*

DUNCAN AND MELROSE STREETS **PHILADELPHIA 24, PA.**

Pepco's Rate Hike

(*Continued from page* 166)

witness for General Services Administration. PUC found a return between 10.35% and 10.65% would be reasonable. As to over-all rate of return, commission said that 5.75% to 5.85% would be just and reasonable. In allowing an increase in rates in the amount of $3.8 million, the PUC in effect gave the company the higher of the two returns.

As to the determination of the rate base, the PUC agreed to the use of an "end of the year' investment rate base instead of the weighted net average investment which the commission has used heretofore. This was done, the PUC said, in order to provide a counter-balance to the "attrition" in earnings resulting from the need to make large new investments at prices considerably higher than the average cost of existing plant. What the PUC is saying, in effect, is that incremental return on incremental investment is inadequate.

In addition, the commission allowed construction work in progress to be included in the rate and an amount for materials and supplies.

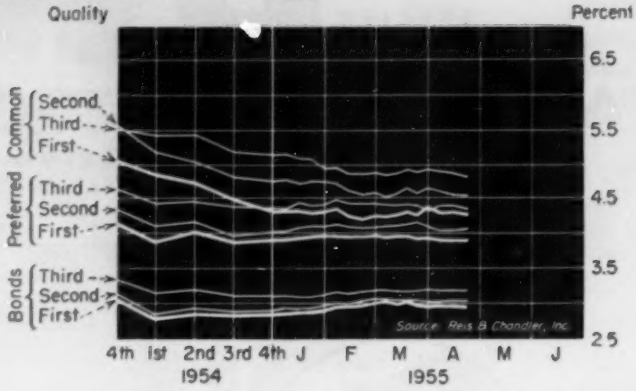
Fair Value Prescribed

It is of interest to note that while the PUC has used an investment rate base, the District of Columbia Code, with respect to public utilities, prescribes fair value of the property in a determination of the rate base.

As to the abandonment of the "Modified Sliding Scale Plan," the commission noted that its workability was dependent on stable market rates for capital and "that within a reasonable period of years there will be an approximate balance between earnings above and earnings below the return which the plan sets as the norm." These conditions did not prevail since the Modified Plan became operative.

The commission quoted that "On the contrary, the change in price levels with its effect on earnings has resulted in a failure to create the kind of cushion against deficiencies which the Plan contemplated but has instead resulted in a cumulative deficiency now totalling $2,467,000. These same factors have resulted in the abandonment of similar plans by those jurisdictions throughout the country which had adopted them."

Today's Utility Yields—(%)



	BONDS			PREFERRED STOCKS			COMMON STOCKS		
QUALITY	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
April 21	2.99	3.03	3.19	3.91	4.04	4.37	4.28	4.52	4.85
April 14	2.99	3.02	3.18	3.92	4.03	4.39	4.32	4.52	4.86

Utility Earnings

COMPANY	PERIOD MONTHS ENDED		NET INCOME 1955	NET INCOME 1954	EARNINGS PER COMMON SHARE 1955	EARNINGS PER COMMON SHARE 1954
Carolina Power & Light	12	Mar.	$8,297,118	$7,399,201	$....	$....
Central Hudson Gas & Electric	12	Mar.	3,319,804	2,762,734	1.02	0.95
Central Vermont Public Service	12	Mar.	1,423,207	993,599	1.32(a)	0.91(a)
Detroit Edison	12	Mar.	23,516,009	20,656,041	2.18(a)	1.94(a)
Florida Power & Light	12	Mar.	11,544,595	8,934,500	3.79(b)	3.27(b)
Houston Lighting & Power	12	Mar.	13,151,807	10,588,067	2.19	1.93
Montana Power and subsidiaries	12	Mar.	7,672,622	7,574,057	2.62	2.67
New York State Electric & Gas	12	Mar.	9,582,345	9,437,318	2.63	2.65
Niagara Mohawk Power	12	Mar.	28,342,833	26,582,231	2.14	2.05
Ohio Edison and subsidiary	12	Mar.	21,060,624	19,596,037	3.15(a)	3.11(a)
Oklahoma Gas & Electric	12	Mar.	7,414,017	5,884,211	2.26(c)	1.83)c)

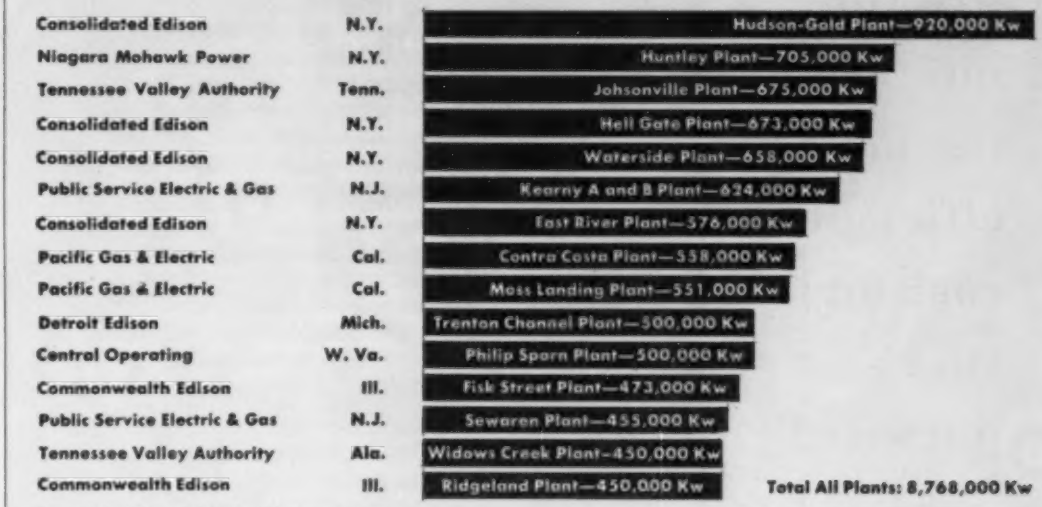
Notes—(a) Based on average shares outstanding; (b) Based on 2,695,000 shares in 1955 and 2,450,000 shares in 1954; and (c) Based on 2,723,055 shares in 1955 and 2,653,140 shares in 1954.

Utility Financing

COMPANY AND DESCRIPTION	AMOUNT OF OFFERING (000)	OFFERING PRICE	YIELD TO PUBLIC
WEEK of APRIL 21-27			
COMMON STOCK			
Western Light & Telephone—87,092 sh (being offered commonholders on 1-for-7 basis, record April 15 to expire May 4)	$1,541	$27.00	5.93%
SCHEDULED FOR MAY			BID DATE
BONDS AND DEBENTURES			
Georgia Power—1st mtg due 1985	$12,000	.....	May 10
Jersey Central P&L—1st mtg due 1958	20,000	.....	May 10
Ohio Edison—1st mtg due 1985	30,000	.....	May 17
Alabama Power—1st mtg due 1985	15,000	.....	May 24
Southern California Edison—conv. debs due 1970 (to be offered common and preferred holders on the basis of one right for each share held with 20 rights entitling holder to subscribe for $100 of debs)	40,951	$100.00	.....
PREFERRED STOCK			
Public Service of Oklahoma—100,000 sh $100 par	$10,000	.....	May 17
COMMON STOCK			
Florida Power Corp—232,887 sh (to be offered commonholders on 1-for-10 basis, record May 9)	.....	.....	.....
Iowa Public Service—270,220 sh (to be offered commonholders on 1-for-10 basis, record May 11)	.....	.....	.....

STATISTICS

9% of Nation's Capacity Found at the Top 15 Steam Plants


Consolidated Edison N.Y. Hudson-Gold Plant—920,000 Kw
Niagara Mohawk Power N.Y. Huntley Plant—705,000 Kw
Tennessee Valley Authority Tenn. Johnsonville Plant—675,000 Kw
Consolidated Edison N.Y. Hell Gate Plant—673,000 Kw
Consolidated Edison N.Y. Waterside Plant—658,000 Kw
Public Service Electric & Gas N.J. Kearny A and B Plant—624,000 Kw
Consolidated Edison N.Y. East River Plant—576,000 Kw
Pacific Gas & Electric Cal. Contra Costa Plant—558,000 Kw
Pacific Gas & Electric Cal. Moss Landing Plant—551,000 Kw
Detroit Edison Mich. Trenton Channel Plant—500,000 Kw
Central Operating W. Va. Philip Sporn Plant—500,000 Kw
Commonwealth Edison Ill. Fisk Street Plant—473,000 Kw
Public Service Electric & Gas N.J. Sewaren Plant—455,000 Kw
Tennessee Valley Authority Ala. Widows Creek Plant—450,000 Kw
Commonwealth Edison Ill. Ridgeland Plant—450,000 Kw
Total All Plants: 8,768,000 Kw

Source: Federal Power Commission 1954 Annual Report

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Feb.	103.74	103.62	92.46	12.2
Peak—Class I Systems, million kw		83.9	84.1	74.9	12.0
Estimated Dec. '54 Peak		96.4	95.7	96.2	0.2
Production—billion kwhr	Feb.	40.23	43.96	35.21	14.3
hydro		8.57	9.43	8.56	0.1
fuel		31.66	34.53	26.65	18.8
Sales—billion kwhr	Dec	35.25	33.87	32.31	9.3
residential		11.15	10.07	9.77	14.0
commercial		6.22	6.14	5.60	8.5
industrial		15.57	15.38	14.83	6.8
other		2.30	2.29	2.12	7.5
Fuel Consumption	Feb.				
coal—million tons		11.09	12.02	9.07	22.3
oil—million barrels		7.43	8.91	5.70	30.4
gas—billion cu ft		63.63	65.13	75.74	−16.0
Net Income Class A & B Co's—$ million	Jan.	112.60	109.05	111.44	1.0
Residential Customers—millions	Dec.	43.14	43.04	41.98	2.8
revenue per kwhr		2.69¢	2.70¢	2.74¢	−1.8
avg. kwhr per customer		2,549	2,528	2,346	8.7
avg. annual bill		$68.57	$68.26	$64.28	6.7

Business Statistics . . .

Indexes: 1947−49 = 100					
FRB Industrial Production	Mar.	137	135	126	8.7
ENR Construction Cost	Mar.	135.4	135.1	128.7	5.2
BLS Cost-of-Living	Mar.	114.3	114.3	114.8	−0.4
NEMA Sales	Feb.				
insulation materials		137	132	120	14.2
electric appliances		118	118	98	20.4
household refrigerators		94	96	91	3.3
Wholesale prices	Mar.				
motors and generators		121.0	121.0	124.2	−2.6
transformers and regulators		127.8	127.8	128.1	−0.2
switchgear and fuses		135.4	135.4	135.1	0.2
GNP—annual rate—$ billion	1st Qtr.	$369.0	$362.0	$355.8	3.7

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No two plants are alike—design and equipment characteristics make the difference. That's why it's so important to consider *kind* and *size* when selecting a coal for your particular burning equipment. The B&O Technical Service is prepared to study your specific problem and help you choose the correct coal. Here's what our service does for you:

- outlines Bituminous coals available for your plant.
- discusses the merits of these coals.
- establishes current and predicts future relative values of these coals.
- determines the best coal for your system.
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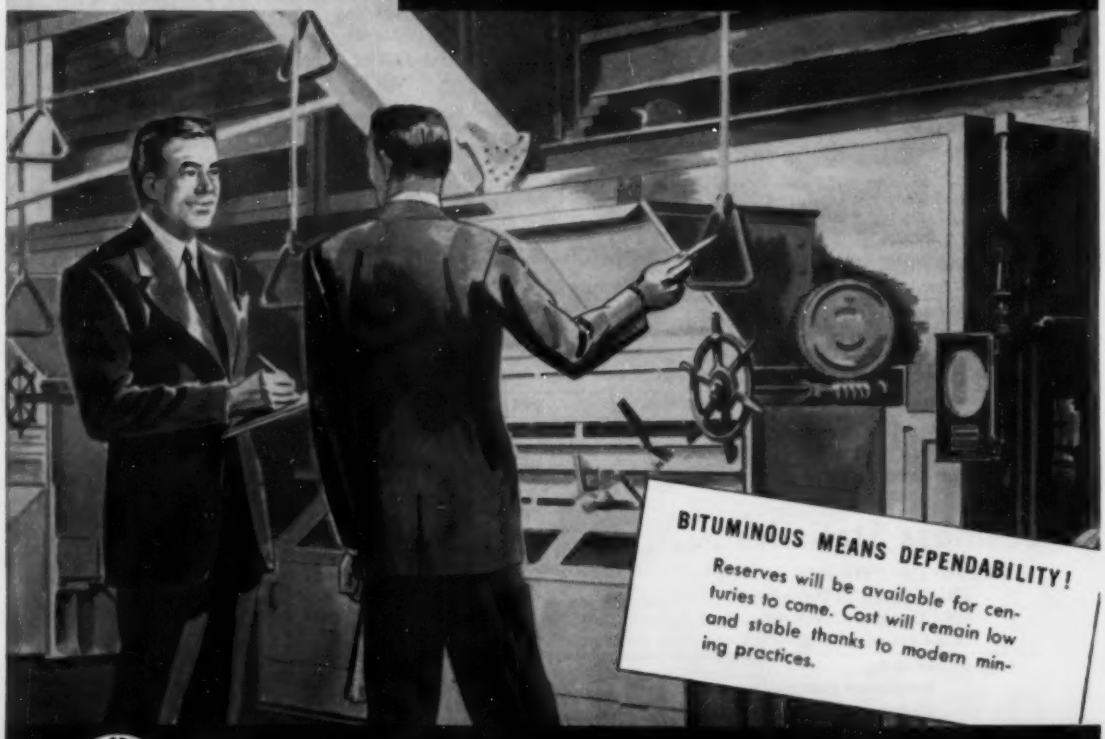

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Reserves will be available for centuries to come. Cost will remain low and stable thanks to modern mining practices.

Baltimore & Ohio Railroad

Constantly *doing things*—better!

BITUMINOUS COALS FOR EVERY PURPOSE

Exide-equipped! The Jersey Central Power & Light Company's South Amboy plant relies on Exides. They provide the most dependable and durable power source for the unfailing operation of vital electrical equipment.

Switchgear operation assured for

JERSEY CENTRAL POWER & LIGHT by Exide-Manchex® Batteries

The positive operation of switchgear is assured by the dependable performance of Exide Batteries. They control the switchgear equipment in the South Amboy Plant of the Jersey Central Power & Light Company pictured above.

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DEPENDABLE POWER which assures instant operation of circuit breakers

LARGE RESERVE OF POWER for all control circuits and emergency lighting

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NO ELECTROLYTE CHANGE during entire life of battery

LOW COST MAINTENANCE—water needed only twice a year

LARGE CAPACITY IN SMALL SPACE

EXCEPTIONALLY LONG LIFE... low cost for owning and operating

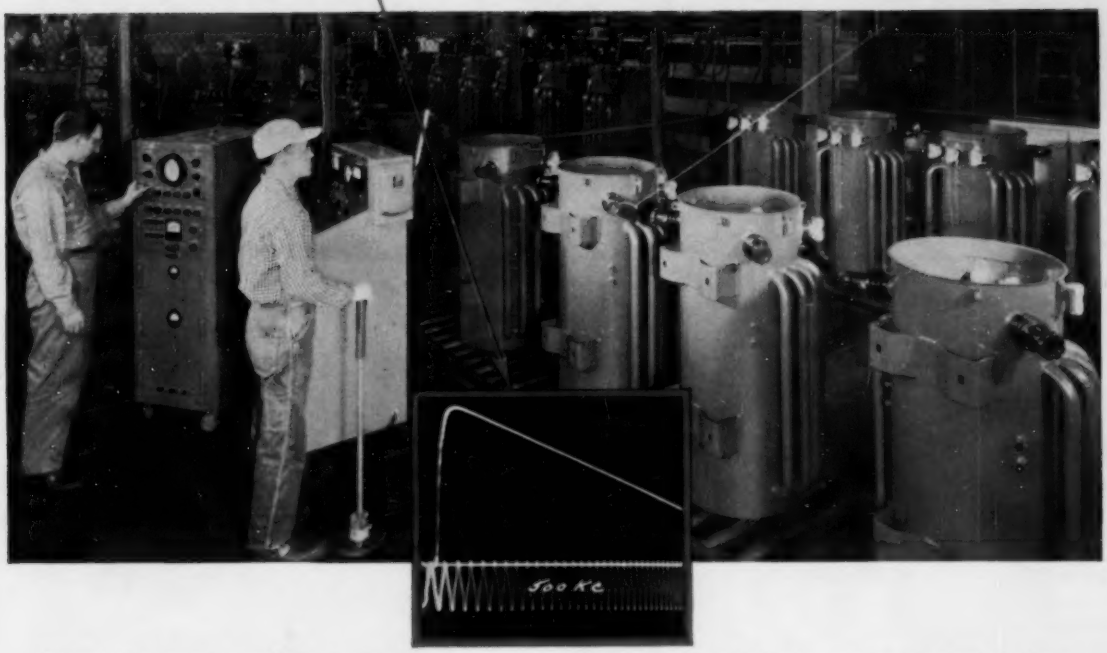
These are the performance and operating features of the Exide-Manchex battery which make it your best power buy—AT ANY PRICE.

Get more details! For complete data on Exides used in switchgear control, emergency light and power, send for Bulletin 210. Call your nearby Exide branch office for complete battery engineering service.

Exide-Manchex Batteries, like those relied upon at the South Amboy plant of the Jersey Central Power & Light Company, are also used by electric utilities all over the country. Exide-Manchex Batteries are your best switchgear power buy—AT ANY PRICE!

Exide INDUSTRIAL DIVISION, The Electric Storage Battery Company, Philadelphia 2, Pa.

Production-Line *Impulse Test* for Every Distribution Transformer



Using the most modern impulse testing and recording equipment, Allis-Chalmers gives you proof of insulation performance for every distribution transformer through 500 kva, 69 kv. These tests are made both on conventional and self-protected designs.

Allis-Chalmers initiated production-line impulse testing to assure that no transformer can be shipped without positive proof that insulation can withstand severe lightning and line surge conditions. No lightning arrester is used in these tests. Allis-Chalmers tests the tranformer, not the lightning arrester.

It will pay to get complete information about this and other Allis-Chalmers tests and production procedures that result in distribution transformers of highest quality. Contact your nearby A-C office or write Allis-Chalmers, Milwaukee 1, Wisconsin, for additional information. A-4638

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